EVIDENCE REPORT
No 63

Policy Anticipation, Response and Evaluation

Exploring the Potential and Limits of the Resilience Agenda in Rapidly Urbanising Contexts

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March 2014

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The material has been funded by UK aid from the UK Government, however the views expressed do not necessarily reflect the UK Government's official policies.

AG Level 2 Output ID: 249

EXPLORING THE POTENTIAL AND LIMITS OF THE RESILIENCE AGENDA IN RAPIDLY URBANISING CONTEXTS

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First published by the Institute of Development Studies in March 2014

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Acknowledgements

The authors would like to thank Aditya Bahadur, Miniva Chibuye, Alejandro Guizar, Gordon McGranaham, Maxmillan Martin, Jim Sumberg, Pedram Rowhani, and Manoj Roy for their participation in the Foresight Workshop. The technical guidance of Alun Rhydderch during the preparation and implementation of the foresight exercise is gratefully acknowledged. A special thanks to Gordon McGranaham (IIED) for his comments on an earlier version of this report. Errors and omissions remain those of the authors of this report only. This project was funded by the IDS Horizon Scanning Initiative.

1 Problem statement and key issues

More than half the world's population now live in urban areas. In developing countries, these areas will become home to almost all of the projected 50 per cent population growth that will occur between now and 2030, swelling urban populations by a further 1.3 billion by 2030 and 2.5 billion by 2050 (GMR 2013). As a result, by the middle of the century, urban dwellers will account for more than 85 per cent of the population in the more developed countries and more than 65 per cent in the less developed regions. Overall, it is expected that seven out of ten people will be living in urban areas by 2050 (UN-Habitat 2011).

In this rapidly changing environment, megacities, urban corridors and city regions have attracted the largest attention of both academics and policymakers. In comparison, far less is known about smaller and emergent urban areas (Ferre, Ferreira and Lanjouw 2011), even if most of the current urban population in the world live in small and medium towns (WUP 2012) and the major part of population growth is projected to take place in those towns under one million people (using 2005 UN population estimates).

It is sometimes assumed that urbanisation is a positive outcome of development. However, this issue obscures the fact that the percentage of the poor who live in urban areas is globally increasing (Ravallion, Chen and Sangraula 2007). Thus, poverty is also an increasingly urban phenomenon. Many sections of the urban population suffer from higher levels of deprivation than those experienced by the rural poor (Harpham 2009). As a consequence, the number of slum dwellers in the developing world has risen from 767 million in the year 2000 to an estimated 828 million in 2010. In sub-Saharan Africa, the number of slum dwellers has almost doubled over the past 15 years and an estimated 71.8 per cent of the urban population currently lives in under-served informal settlements (UN-Habitat 2007).

However, these general trends mask a number of more complex issues. First, the definition of exactly what constitutes an 'urban' area is not always clear. Different countries have different ways of defining the term. In some countries (especially China) city boundaries incorporate significant amounts of farming land and, in some cases, these would be defined as rural; in other cases, they would be considered peri-urban; and in yet other cases, they would be urban. In other parts of the world, rates of urbanisation are contested, and might be in some cases significantly overestimated (Potts 2012).

Second, the simple distinction between urban and rural obscures a number of key issues, in particular relating to urban expansion on the fringe of the city. In the peri-urban interface, rural and urban dynamics overlap and poor people often settle in inadequate housing on the periphery of cities in response to a lack of affordable housing options within the city itself, leading to the creation of informal and often illegal slums with poor access to infrastructure and public services, and exposed to high climate-related risks (e.g. floods, landslides).

Land use changes are particularly rapid in these peri-urban interfaces, with wetlands and agricultural land being converted to sites for industries, IT hubs, infrastructure and housing estates for both rich and poor, including migrants. As a consequence, land speculation is often widespread, with pockets of wealthy new property developments surrounded by informal settlements (Marshall *et al.* 2009; Mehta *et al.* 2014, forthcoming). Both rural and urban authorities often fail to address the needs of peri-urban communities that are often characterised by political marginality (*ibid*.). These areas are also often described as involving 'glocal' dynamics, given the dynamic flows of people, commodities, capital, natural resources, waste and pollution, and conflicts over land tenure and water (Marshall *et al*. 2009; Mehta *et al*. forthcoming).

In the context of rapid urban expansion, climate change is likely to become a magnifier of some of the current tensions and pressures around resources in rapidly urbanising areas. It is in this context that the concept of resilience is becoming a particularly prominent policy narrative (ICLEI 2011; World Bank 2011); it started to receive increasing attention in academic and policy circles in the 1990s, and is beginning to underpin policy and practice as a new framework for integrating climate change adaptation with development planning and programming (DFID 2011; IRWG 2012; Practical Action 2012; Twigg 2007). Resilience is now widely regarded as something that individuals, households, communities or even societies should strive for, in particular in relation to climate change and the challenges that it brings in the urban context (Chelleri 2012; Dodman and Satterthwaite 2008; Gasper, Blohm and Mathias 2011; Leichenko 2011; Romero-Lankao and Dodman 2011). As such it increasingly diverges from its earlier usage (as a neutral, technical characteristic of a system – see section below), which did not have this normative dimension.

While resilience thinking has a long history in environmental systems (Folke 2006; Holling 1973), social dimensions have more recently begun to be integrated, leaving scope to address issues concerning governance, politics and social justice (Adger *et al*. 2009; Leach 2008). Yet a growing number of academics still argue that there is a real danger of misuse, or abuse of the term (e.g. Bahadur and Tanner, 2014, forthcoming; Béné *et al.* 2012; Cannon and Müller-Mahn 2010; Duit, Galaz and Eckerberg 2010; Leach 2008), as it seems to be increasingly co-opted to accommodate rather than challenge the status quo and processes that are socially and/or environmentally harmful. It can be argued that through their support for or reference to the concept of resilience, some institutions are in effect supporting business as usual, possibly with the objective of making communities more resilient to the shocks and inequity created by the growth model. In that context resilience does not support the process of transformation that may be necessary in the long run, and is potentially inadequate as a guiding principle for foresight.

2 Project overall approach

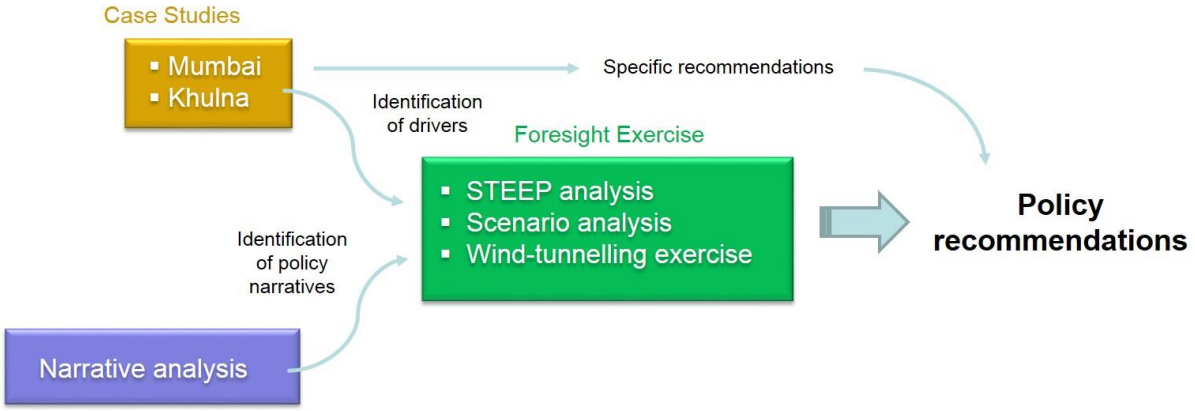
As part of the Tomorrow-Today Horizon Scanning Initiative supported by IDS, the project 'Exploring the Potential and Limits of the Resilience Agenda in Rapidly Urbanising Contexts' aims to analyse the emergence of the concept of 'urban resilience' in the literature and to assess the potential and limitations of this concept as an element of policy narrative, especially in the context of rapid urbanisation processes. In order to give a more empirical dimension to this analysis, we also included two case studies (one large city – Mumbai in India, and one smaller city – Khulna in Bangladesh) with the aim of relying on these case studies to better understand some of the crucial processes characterising urbanisation, to scrutinise the dynamic and evolving linkages and processes that connect the rural and the urban in the peri-urban interface and the ways in which resources are differently defined, appropriated and used by various interest groups.

The project first drew on a narrative analysis, using secondary data on urban resilience. The main objective of this narrative analysis (see Section 3) was to identify the different narratives that exist in the literature around the concept of urban resilience and to analyse how these narratives influence policies concerning urbanisation.

Second, given the increasing number of people who will live in cities in the future, the narrative analysis was then combined with a foresight exercise. Drawing on the two case studies as an initial empirical anchor for the exercise, a series of foresight analyses were conducted by a group of experts under the technical guidance of a foresight expert (see Section 4). The main objective of this foresight exercise was to explore the ways in which the different narratives and scenarios around urban resilience could influence urbanisation if they were to be integrated into future policy frameworks.

A series of policy recommendations were then identified from this series of analyses. The different elements of this general approach are presented in Figure 2.1.

Figure 2.1 The general approach of the project and its different elements



3 Narrative analysis

3.1 Theoretical background

The narrative perspective, which derives from linguistics, the literary arts, and constructivism, holds that meaning is a highly contextualised, locally constructed phenomenon that relies heavily on language: '[N]arrative knowing assumes that individuals perceive the same world differently depending on their values, interests, and histories' (Bridgman and Barry 2002: 142).

Following this line of thinking, narrative approaches to policy analysis assume that language does not simply mirror the world, but instead reflects and shapes our view of it in the first place (cf. Fischer and Forester 1993; Roe 1989, 1994). Understanding narrative is therefore critical in relation to science, expertise and the ways this knowledge can be used to justify or legitimise particular decisions and policy orientations.

In the context of urbanisation and urban policies, where scientific expertise plays a major role in framing policy debates, it can be argued that any conception of the world that becomes dominant in policy discussions will be instrumental in shaping the way future urbanisation and urban planning will be conceived and implemented. The recent emergence of resilience narratives that are used to analyse and act on urban issues, and provide a goal for individuals, communities, cities or societies therefore warrants further attention.

3.2 Methods

A review of the literature was first completed to identify the main existing studies on urban resilience. The result of this review was then used in the narrative analysis. For the review the criteria of inclusion/exclusion were as follows:

- Source: Web of Science + BIOSIS + MEDLINE
- Research domains: Science and technology + Social science + Arts/Humanities
- Research areas: Environmental science ecology + Urban studies + Sociology + Public administration
- Keywords in title: 'urban'/'city'/'cities' *and* 'resilience'/'resilient'
- Only peer-reviewed material (no books)
- Published after 2003 (ten-year period) [Aug 2013]
- Language: English
- Excluded: Sociopsychological/medical studies of individual (child) resilience in urban context
- Excluded: Terrorism/security studies

The choice of the limited period: 2003–2013 and the category 'title' for the keywords (as opposed to 'title+abstract' or even 'whole document') was deliberate in an attempt to limit the number of articles reviewed to a manageable size. From the initial search, 64 articles were identified with both keywords 'urban'/'cities' *and* 'resilience'/'resilient' in their titles (see Appendix 1 for the list). From these, 25 were further discarded as they covered either terrorism/security or sociopsychological/medical issues. Thirty-nine articles remained – listed in Appendix 2. Those 39 articles were then used in the narrative analysis (Section 3). This analysis was structured by a series of interrogations:

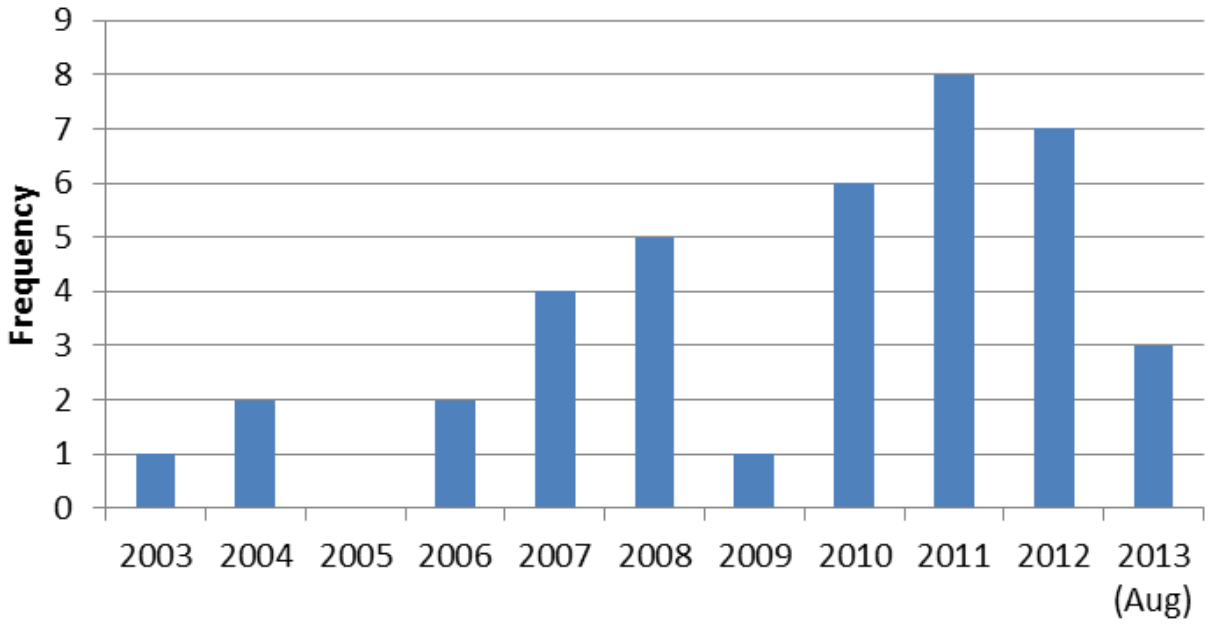
- What are the different narratives on ‘urban resilience’ or ‘resilience in the urban context’?
- How are these different narratives constructed? In particular,
  - What is the initial key problem that is identified and how does resilience contribute to addressing this problem?
    - Is resilience presented as the means or the end?
    - What definition of resilience is used for this?
    - What characteristics of resilience are emphasised and why?
    - What underlying assumptions (explicitly or implicitly) are made?
  - What are the commonalities between the different narratives?

3.3 Narrative analysis findings

3.3.1 Increasing prominence in the literature

The notion of resilience is gaining increasing prominence within the literature on cities and climate change. As Evans puts it (Evans 2011: 22), ‘The attraction of resilience… is fairly obvious’. Frequently used terms such as ‘climate-resilient’, ‘climate-proofing’ and the ‘resilient city’ emphasise the idea that cities, urban systems and urban constituencies will need to be able to absorb, adapt or transform from climate-related shocks and stresses in the future.

Figure 3.1 Number of peer-reviewed articles published on urban resilience (see details in text)



There is therefore a growing number of studies that propose to explore more rigorously these issues in the literature on urban planning and climate change. Figure 3.1 illustrates this increasing trend based on the 39 articles included in this review, recognising, however, the existence of a wider range of publications discussing urban resilience.

3.3.2 Resilience as a dynamic, malleable concept[1]

It also soon becomes apparent that identifying these different narratives cannot be done by simply providing a 'static' snapshot of the current literature. The different interpretations and definitions of resilience that underpin these various narratives on urban resilience as we will present them below are themselves dynamic and 'malleable'. They have evolved – and are still evolving – over time. The next series of paragraphs aims at presenting a succinct overview of how the concept of resilience has progressively evolved, branching out from a single everyday term into a series of different and increasingly sophisticated scientific concepts characterised by different and specific definitions (see Figure 3.2).

In its original day-to-day sense, 'resilience', which derives from the Latin verb '*resilire'* (meaning 'to jump back') was used to refer to 'the capacity to recover quickly from difficulties; toughness' (Stevenson 2014). Some authors trace back the first 'scientific' use to the definition of the 'modulus of resilience' used in the context of nineteenth century warship design. Naval architect Robert Mallet developed this modulus of resilience as a means of assessing the ability of materials to withstand severe conditions. In the 1940s and 1950s the concept emerged in psychology in the context of the negative effects of adverse life events such as exclusion, poverty and traumatic stressors on vulnerable individuals and groups – in particular children (Glantz and Johnson 1996). The engineering/physics interpretation of resilience (possibly deriving from Mallet's modulus of resilience) became progressively apparent in the 1960s and 1970s, where resilience was then formally defined as 'the capacity of a material to absorb energy when it is deformed elastically and then, upon unloading to have this energy recovered' (Hollnagel, Woods and Leveson 2006). Soon after, ecologists picked up the concept and started to use it to describe some aspects of ecosystem dynamics around equilibrium. One of the most quoted definitions (often – but wrongly – presented as the original definition of resilience) is that proposed by Holling in the seminal work on 'Resilience and Stability of Ecological Systems', where resilience was defined as 'a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist' (Holling 1973: 17).

To some extent Holling's work marks the 'renaissance' of the concept of resilience (Bahadur, Ibrahim and Tanner 2010) which started to gain increasing popularity in ecology but also in several other disciplines and sub-disciplines. Disaster risk reduction (IFRC 2004; Klein *et al.* 1998; Tobin 1999; WCDR 2005) and then climate change adaptation (Allison and Hobbes 2004; IPCC 2012; Moser *et al.* 2010) adopted the concept in the 1980s. The IPCC now defines resilience as the 'ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner' (IPCC 2012: 5).

In parallel some social science scholars working in close collaboration with the group of ecologists who embraced the concept of resilience in the late 1970s, started to apply it to some social contexts. Although they did not necessarily seek to define resilience in a specific social sense, they were interested in identifying the characteristics of social systems (groups, communities, society) that would facilitate or foster the resilience of these social systems. Drawing on these two parallel strains, the concept of social-ecological resilience emerged in the late 1990s (Folke 2006; Walker *et al.* 2004). Social-ecological resilience was embedded in a new paradigm based on system thinking that was meant to overcome the separation of the social from the natural sciences, and create a new intellectual basis for responding to the 'environmental' challenges of the modern world (McGranaham pers. comm.).

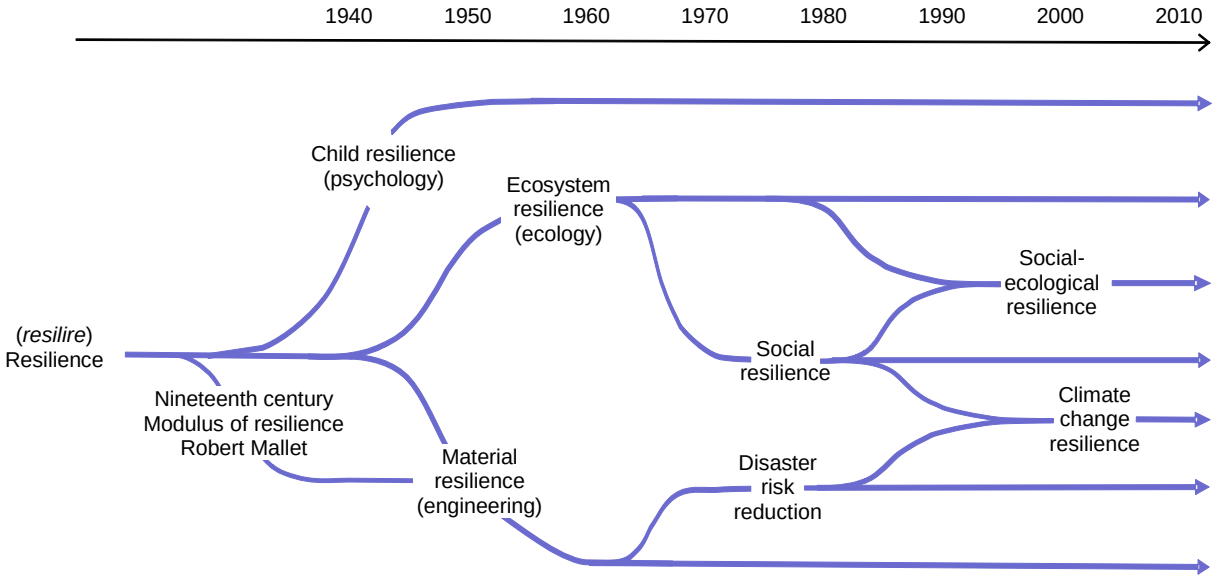
Under this social-ecological thinking, 'resilience… is not simply about resistance to change and conservation of existing structures [the engineering definition]' (Folke 2006: 7) or even

[1] This sub-section does not refer exclusively to the 39 articles included in the narrative analysis. All the other sub-sections of the narrative analysis (Section 3), however, do.

about ‘buffer capacity and persistence to change while maintaining the same function’ (the ecological definition), but is instead viewed as an emergent property that also includes two other dimensions: the adaptive capacity – that is, ‘the capacity to learn, combine experience and knowledge, adjust responses to changing external drivers and internal processes, and continue operating’ (Berkes, Colding and Folke 2003); and the transformative capacity – that is, the ‘capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable’ (Walker *et al.* 2004: 5).

These various branches constitute the lineages from which urban resilience emerged in the early 2000s (see Figure 3.2). As we will see below, urban resilience did not, however, draw equally from all these different influences. Three schools of thought have been more predominant in influencing the urban resilience narrative: the disaster risk reduction community initially closely linked to the engineering understanding of resilience, ecological resilience, and social resilience.

Figure 3.2 Evolutionary path of the concept of resilience and emergence of the different schools of thoughts and their lineages



3.3.3 From common language to scientific concept and back

Another key finding that emerges from looking more systematically at the literature is that the precision with which the term/concept of resilience is defined in relation to urban issues varies greatly between articles, irrespective of the actual meaning proposed in the definition. More concretely, three levels of ‘precision’ can be identified (Table 3.1). At the highest level, resilience is defined as a clear (academic) concept by the author(s) who generally rely either on a new or an existing definition, and often make reference to a specific body of literature. Agudelo-Vera *et al.* (2012), for instance define resilience ‘as a measure of robustness and buffering capacity of the system to changing conditions’ and the article makes specific reference to Berkes and Folke (1998) (Agudelo-Vera *et al.* 2012: 3).

Table 3.1 The different levels of definition of the term resilience as found in the urban resilience literature

Nature of the definition	Examples	Meaning
A clear (academic) concept (relying on theory)	Agudelo-Vera *et al.* (2012)	Specific
A clear (academic) concept (relying on theory) and applied/transferred to cities/urban entities	Leichenko (2011); Malalgoda, Amaratunga and Haigh (2013)	
A series of definitions (pluralistic approach)	Baud and Hordijk (2009); Pearson (2013)	
A common word meaning	Boyle (2012); Campanella (2008)	
No proper definition (implicit)	Bouzarovski, Salukvadze and Gentile (2011); Gleeson (2008)	Vague

In other cases, the concept of resilience or urban resilience *per se* is not defined, but the authors define what a 'resilient city' is. Malalgoda *et al.* (2013: 73), for instance, define a resilient city as 'a city that has developed the systems and capacities to be able to absorb future shocks and stresses over time so as to still maintain essentially the same functions, structure, systems, and identity, while at the same time working to mitigate the present causes of future shocks and stresses'. In a similar way, Leichenko (2011: 164) defined urban resilience as 'the ability of a city or urban system to withstand a wide array of shocks and stresses'. In most cases, the definition has therefore usually been derived from ecology theory but explicitly adapted to an urban context: 'By resilience we mean the ability of a city to withstand shocks and threats, to survive stresses and to adapt to social, political, economic and environmental change' (Monteiro *et al.* 2012: 113). In some other cases, however, resilience remains an ecological concept and the 'transferability' to the city is not totally endorsed. Colding, for instance, defined resilience as 'the capacity of an ecosystem to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity and feedbacks' (Colding 2007: 46). We find a similar approach in Barthel and Isendahl (2013: 225): 'Social-ecological resilience is defined as the capacity to absorb shocks, utilize them, reorganize, and continue to develop without losing fundamental functions (Carpenter and Folke 2006)'.

In some other cases the author(s) acknowledge the existence of many different definitions of the term 'resilience' – and even provide these definitions – but do not necessarily select one of them. Instead they embrace this large variety of definition in what Pearson calls a 'pluralisitic use of the term':

> resilience is generally conceived as the ability of a system (e.g. city system) to absorb disturbance and reorganize to retain 'essentially the same function, structure, identity and feedbacks' (Walker *et al.* 2004). We are *pluralistic* in our use of the term, finding useful insights from; resilience in ecology (Holling 1973), adaptive capacity in social-ecological systems (Berkes *et al.* 2003), transition studies in social–technological systems (Rotmans *et al.* 2001) and adaptation in social systems (Cote and Nightingale 2011).
> Pearson (2013: 222 [our emphasis])

Resilience in the urban literature may also be used in a relatively loose manner – that is, with no specific definition. In some cases a short explanation of that meaning is provided – although usually not presented as a proper definition. Boyle, for instance, refers to resilience in the following terms: 'this article begins by linking resilience to the broader idea of precaution and argues for an understanding of precaution that includes contingency planning and response alongside the more familiar characteristics of anticipation and preemption' (Boyle 2012: 352). In other cases no explanation is provided but the implicit meaning usually refers to the contemporary sense of resilience as the 'ability to adapt and to bear hardship'. Bouzarovski *et al.*, for instance, present resilience as 'part of an expanding scholarly attempt to assess the ability of cities across the world to transform their political, economic and

technical structures in line with the demands of a more challenging future environment' (Bouzarovski *et al.* 2011: 269). Other examples of loose use of the concept include Gleeson (2008), Antrobus (2011), or Jansson (2013).

3.3.4 Different ways to use resilience

In examining the literature on urban resilience, the review highlighted not simply the growing variety of definitions and interpretations of the term 'resilience', but also the wide range of uses of the concept. Irrespective of how people interpret or define resilience, the concept is not necessarily always used with the same purpose. Table 3.2 synthesises the different utilisations that were identified through the 39 articles included in this review, and provides some examples extracted from the literature. The first way resilience is used is as **a goal** for cities to achieve. The objective here is to ensure that cities are 'resilient'. For instance, in the context of energy, to become 'energy-resilient' (that is, to operate reliable supplies and stable costs) is regarded as vital for cities due to the growing reliance of developed nations on imported energy and the increased likelihood of supply disruption (Coaffe 2008). In that case, energy resilience is seen as the 'target' and decisions are aimed at achieving this target.

Table 3.2 The different ways the term 'resilience' is used in the urban resilience literature

Use	**Examples**
A **goal** (what to aim at)	Energy resilience: reliable supplies and stable costs of energy (Coaffe 2008)
An **analytical/conceptual tool** (to understand the problem and find better solutions)	Resilience theory to develop a better approach to urban flooding (Liao 2012)
A **metaphor** (to help break silo)	Resilience as a metaphor to help link ecology and planning (Pickett, Cadenasso and Grove 2004)
An **indicator** (of sustainability)	Milman and Short (2008); Monteiro *et al.* (2012)
A **buzzword** (as a strategy to publish)	
No use beyond the title (part of the buzzword?)	Burch (2010); Wallace *et al.* (2007)

A second relatively frequent way the concept of resilience is utilised in the urban literature is as an **analytical/conceptual framework** to help us think about certain issues and find adapted solutions. A good illustration of this approach is Liao (2012), who proposes two interpretations of resilience (engineering and ecological resilience) to develop a theory on 'urban resilience to floods' as an alternative framework for urban flood hazard management. Other examples include Ernston and his colleagues (2010) who propose to use resilience theory to help rethink urban planning:

> the traditional paradigm of planning for a predictable future is not only insufficient, but it may, in some ways, also be destructive. This article strives to lay a foundation for transitions in urban planning and governance, which enable cities to navigate change, build capacity to withstand shocks, and locate sources of experimentation and innovation in face of uncertainty… resilience theory from ecological research can contribute to our thinking on this normative goal… Our belief is that a resilience theory for human-dominated ecosystems is critically needed because such ecosystems are spreading across Earth.
> (Ernston *et al.* 2010: 531–2)

The third way resilience is used in the urban literature is as a **metaphor** – that is, as a tool to favour and foster an integrated approach in relation to urban planning. '"Metaphor is a powerful tool for creating new ideas and syntheses, which can suggest how to use an idea or approach developed in one realm in an entirely different realm" (Pickett 1999). [In the present case] Resilience, as a metaphor, can help link ecology and planning' (Pickett *et al.* 2004:

369). Interestingly this role as a 'mobilizing metaphor' (Béné *et al.* 2012) to integrate and mainstream sectors that are traditionally disconnected is also highlighted in other domains such as development, where resilience is used to bring together traditionally disparate communities, for instance disaster risk reduction, climate change adaptation, and social protection (Ulrich, Béné and Newsham 2012; World Bank 2011).

Several other (minor) uses of the term resilience in the context of urban planning were found in the literature. First, resilience is sometimes used as an **indicator**. At least two cases were identified in the 39 articles included in this review. Milman and Short (2008) (but also Evans 2011) propose to use resilience as an indicator of sustainability: 'Based on non-equilibrium theory, complexity and non-linearity, the most recent ecological incarnation of the city is distinctive in emphasising resilience and adaptive learning as the path to urban sustainability in the face of climate change' (Evans 2011: 224). Based on this, Milman and Short (2008) developed a 'Water Provision Resilience (WPR), which serves as an example of how resilience can be incorporated into indicators of sustainability'. The second case where resilience is used as an indicator of sustainability is in Monteiro *et al.* where these authors propose to use Chronic Obstructive Pulmonary Disease (COPD) as a 'good motivator to encourage greater acceptance of interventions that aim to improve the urban resilience to diverse risks' (Monteiro *et al.* 2012: 113). In that case resilience is also seen as the goal – but understood as a way to ensure urban sustainability: 'COPD as a resilience promoter tool in urban sustainable planning' (Monteiro *et al.* 2012: 113).

We will not discuss the last two categories listed in Table 3.2 ('resilience used as a buzzword', and 'no use of the word resilience except in the title'), although some would argue (correctly) that these types of (mis)use should – or could – deserve more attention, not least because they are contributing to the 'lax applications and sloppy implementation [that] are hindering its usefulness' (Pearson 2013: 222).

In the next section we will build on some of the results previously presented to develop a 'map' of the concept of resilience as currently used in the urban literature. Our main objective will be to identify the different narratives that are found in this literature and to 'unpack' the way these narratives are constructed, what their underlying assumptions (some explicit, some implicit) as well as their main emphases are, and how these different interpretations of the same initial concept influence the types of technical solutions and policy orientations that these narratives advocate.

3.3.5 Resilience as a goal of urban planning

The majority of urban resilience papers identified in the literature refer to resilience as an objective that cities should try to achieve through appropriate planning, policies and interventions. For most of these studies, resilience is therefore perceived as a positive characteristic that needs to be strengthened.

As shown in Table 3.3, this normative interpretation leads experts to present resilience as the ultimate goal to be sought in many different contexts and in response to many different issues. In the examples presented in Table 3.3 these issues include climate change, food insecurity, or the 'unsustainability' of the current urbanisation. For Evans (Evans 2011: 225) for instance:

> If climate change is the driver and resilience the goal, then adaptation is the process through which transition will occur… Within this context, [planning] experimentation is supposed to prompt radical social and technical transition by testing out different technologies under a range of conditions in highly visible ways.

For Agudelo-Vera and her colleagues, the problem is not 'the inevitability of climate change' (Evans 2011: 223), but the 'unsustainability of the cities'. The authors go on to say that:

> Considering the current level and rate of urbanization and growing ecological footprints, the impact of inadequate urban resource management has become a global issue… The root of the current urban un-sustainability is the massive resource consumption and waste production beyond natural supply and recycling limits. (Agudelo-Vera *et al.* 2012: 3)

Table 3.3 Resilience as a goal for urbanisation – through different pathways

The problem	The process	The practice	The goal	Reference
Climate change	Adaptation	Planning experimentation	Resilience	Evans (2011)
Unsustainable urbanisation	Technical change	Urban harvest	Resilience	Agudelo-Vera *et al*. (2012)
Food insecurity	Increased food availability	Peri-urban agriculture	Resilience	de Zeeuw, van Veenhuizen and Dubbeling (2011)
Unsustainable urbanisation	Biodiversity conservation	Urban green commons	Resilience	Colding and Barthel (2013)
Climate change	Social change	Transformative governance	Resilience	Rijke et al. (2013)

Agudelo-Vera *et al.* therefore believe that the process through which the resilience of cities can be restored is technical change. In that context the technical fix is the concept of urban harvest – presented 'as a management tool towards more resilient cities' (Agudelo-Vera *et al.* 2012: 4). 'By harvesting urban resources, global impacts are reduced and the resilience of cities can be improved as well' (Agudelo-Vera *et al.* 2012: 3).

Other examples in Table 3.3 include food insecurity (de Zeeuw *et al.* 2011), or (again) unsustainable urbanisation (Colding and Barthel 2013), or climate change (Rijke *et al.* 2013). In all these cases, resilience is the goal that is reached through various impact pathways: through increase in food availability made possible through peri-urban agriculture for de Zeeuw *et al.* (2011); through biodiversity conservation and urban green commons (UGCs) for Colding and Barthel (2013); or through social change and transformative governance for Rijke *et al.* (2013).

In all these examples resilience is eventually what we need to achieve. Taken individually these different uses of the concept of resilience are well constructed and robust. However, once put together into one single framework, resilience appears as the ultimate goal for many different pathways. In fact, comparison of Agudelo-Vera *et al.* (2012) and Colding and Barthel (2013) reveals how the same initial issue (unsustainable urbanisation) calls for different processes ('technical changes' according to Agudelo-Vera *et al.* and 'biodiversity conservation' for Colding and Barthel) and different practices ('urban harvest' for Agudelo-Vera *et al.* and 'UGCs' for Colding and Barthel), yet all lead to the same result (urban resilience).

3.3.6 Resilience as an analytical/conceptual framework in the context of urbanisation

The benefits of adopting the concept of resilience as an analytical framework to understand how systems respond in relation to shock and stress have been widely recognised in the social-ecological systems literature (see for instance, Berkes *et al.* 2003; Carpenter *et al.* 2001; Chapin *et al.* 2009; Walker *et al.* 2006). A current discussion is also taking place in the development literature, in two different directions: one in relation to disaster risk reduction

(see for instance, Levine *et al.* 2012), and one in relation to food security (for instance, Frankenberger and Nelson 2013).

In that respect the growing number of articles that explore the way resilience can be used as an analytical framework in the context of urban studies is not necessarily surprising and we have presented some examples in the previous section. As Evans explains, 'the writings of resilience ecology replacing the language of generally applicable knowledge [helps] discover generally valid meta-principles and frameworks' (Evans 2011: 233). Table 3.4 captures some of these examples. While the table does not claim to be comprehensive, it illustrates the process and also highlights the salient points of this part of our analysis.

Table 3.4 The use of resilience as an analytical framework to 'solve' urban issues

The problem	The framework	Meta-principles	The outcome	References
Cities vulnerable to food shortage	Social-ecological resilience	Diversity and memory	Food security	Barthel and Isendahl (2013)
Cities need to adapt	Social-ecological resilience	Multi-functionality, redundancy and adaptive planning	Resilient sustainability	Ahern (2011)
Cities need to adapt	Social-ecological resilience	Capacities of learning flexible institutions, self-organisation	Adaptive governance	Baud and Hordijk (2009)

Barthel and Isendahl (2013) is our first example. In their paper they choose social-ecological resilience as 'the analytical lens' (Barthel and Isendahl 2013: 225) for their analysis of urban food security systems. They identify two 'meta-principles' that are closely associated with social-ecological resilience, namely (1) diversity and redundancy and (2) memories, experiences and learning, and 'apply these principles of resilience in an inclusive manner, beyond the strict behaviour of sets of species in an ecosystem' (Barthel and Isendahl 2013: 225). Relying on two case studies from widely different historical and cultural contexts – the Classic Maya civilisation of the late first millennium AD and Byzantine Constantinople – they then use these two meta-principles to 'demonstrate' that urban farming is a pertinent feature of urban support systems and that urban gardens, agriculture and water management, as well as the linked social-ecological memories of how to uphold such practices over time, have contributed to long-term food security during eras of scarcity.

Ahern (2011) is the second example in our Table 3.1. In his analysis, he uses resilience theory to help identify which characteristics urban planning should embrace in order to be able to address the contemporary challenges that urban zones and cities are facing, and in particular the need to be adaptable. Relying on lessons from social-ecological resilience literature he identifies a suite of five principles (he called these 'strategies') that are necessary to build urban resilience capacity: multi-functionality, redundancy and modularisation, (bio and social) diversity, multi-scale networks and connectivity (Ahern 2011: 341). Note that this process of transferring lessons from social-ecological resilience literature to the urban context is completed relatively 'lightly':

> Thus with a greater number of species performing a similar function, the ecosystem services provided by any functional group – for example, the decomposers – are more likely to be sustained over a wider range of conditions, and the system will have a greater capacity to recover from disturbance... *Likewise*, cities with higher levels of economic and social diversity have a more complex response diversity by which they are better positioned to adapt to change and socio-economic disturbance.
> (Ahern 2011: 342, our emphasis)

To a large extent the title of Baud and Hordijk's 2009 paper, the third example in Table 3.1, says it all – 'Dealing with risk in urban governance: What can we learn from "resilience

thinking"'. Recognising that 'Uncertainty, unpredictability and change have become key characteristics of today's interdependent world' (Baud and Hordijk 2009: 1069), the two authors propose to identify the main characteristics of resilience thinking and adaptive governance that appear relevant for urban planning. They conclude that these characteristics include flexible institutions, knowledge systems that integrate different sets of knowledge, and the capacities of learning through experiment, creativity and self-organisation.

3.3.7 Mapping the different resilience narratives

The next step in the narrative analysis is to map the different urban resilience narratives together. For this we rely on the findings generated through the questions that structured our research. In particular, we asked: what key problem(s) were initially identified as being critical from an urban resilience perspective, how resilience was expected to contribute to addressing these problems, what definition of resilience was used to solve these problems, and what characteristics of resilience were emphasised.

Figure 3.3 Static map of the resilience narratives related to urbanisation

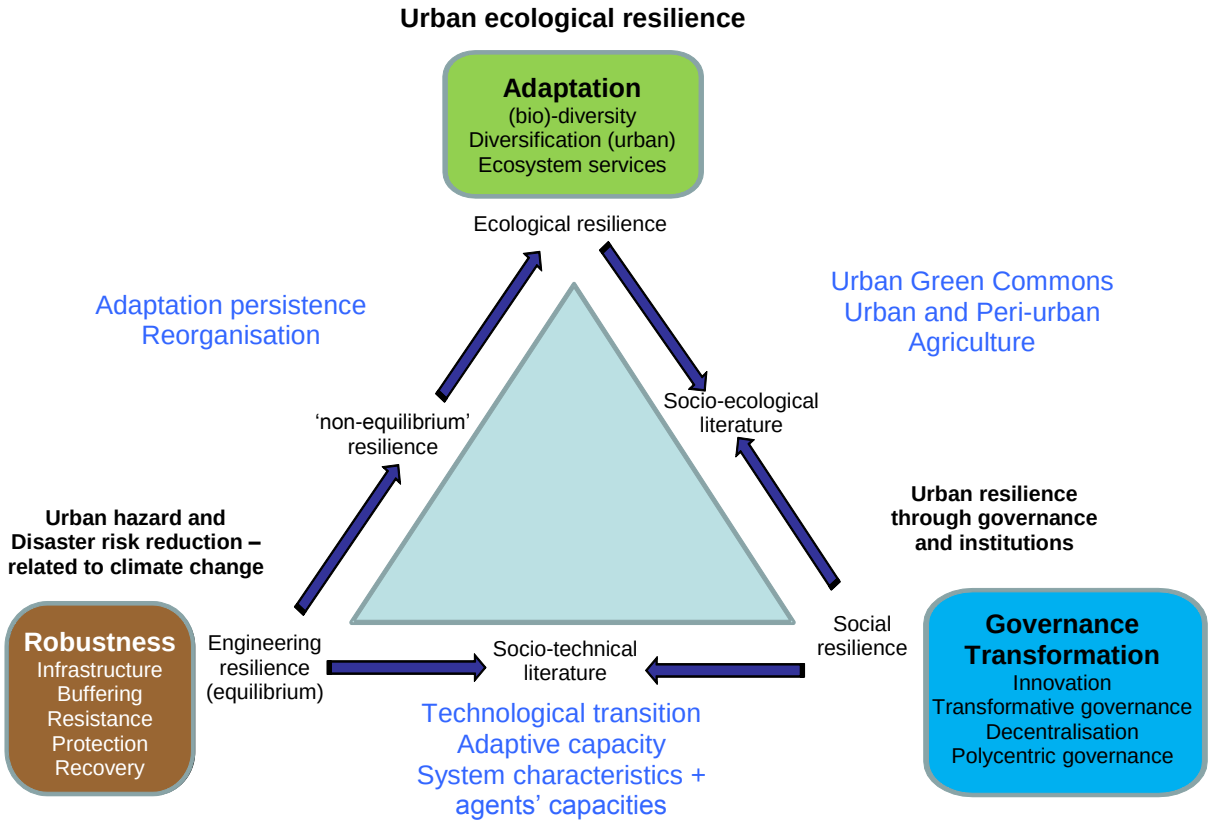


Table 3.5 The three main narratives on urban resilience

	Urban hazards and disaster risk reduction	**Urban ecological resilience**	**Urban resilience through governance and institutions**
The problem	Climate change-related extreme events are threatening urban centres	Urbanisation as currently implemented is (ecologically) unsustainable	Urban centres and planners need to be able to adapt to their uncertain environment
Type of resilience	Engineering resilience	Ecological resilience	Social resilience
What is needed? (resilience characteristics)	**Robustness** ● Infrastructure ● Buffering ● Resistance ● Protection ● Recovery	**Adaptation** ● (bio)diversity ● Diversification ● (urban) ecosystem services	**Governance** ● Social innovation ● Decentralisation ● Participation ● Polycentric governance

As the previous sections made clear, urban resilience can be understood and interpreted quite differently in the literature. That heterogeneity in the usage and interpretation of the concept of urban resilience is partly rooted in the different intellectual origins and lineages as presented in Section 3.3.2 (cf. Figure 3.3), and there can be large disagreement on both the main issues that need to be addressed and the main characteristics that define urban resilience. In fact, even within those schools of thought, a certain level of diversity of interpretation can be observed.

Three generic schools can be distinguished: (1) urban hazards and disaster risk reduction; (2) urban ecological resilience; and (3) urban resilience through governance and institutions. In addition to these, at least two other major schools of thought that are not directly related to urban literature but strongly influence part of the discussion should be mentioned: (1) socio-technological transition; and (2) social-ecological resilience. Those various groups are synthesised in Table 3.5 and represented in Figure 3.3. Note that the aim of Figure 3.3 is to capture and contrast the distinctiveness of each of the main schools of thought that are found in the literature in relation to urban resilience. As such it represents a 'static' and somewhat simplistic snapshot that does not claim to reflect well the dynamic evolution that led to these different schools of thought – and was presented in Section 3.3.2.

Urban hazards and disaster risk reduction

The detrimental impact of climate-related extreme events

The first (and possibly largest) school of thought that anchors its work on resilience thinking in the urban context is that of 'urban hazard and disaster risk reduction'. This includes the work of researchers and practitioners working on issues revolving around natural and human-made hazards in the urban context. A large part of this work is closely related to, and claimed its origin in, the increase in frequency and intensity of climate change-related disasters and extreme events. Emblematic of this work are the numerous articles that have been published following Hurricane Katrina in New Orleans (see for instance, Campanella 2006). Other main streams of work in this thread are the articles discussing flood events such as the 2011 Bangkok or the 2010 Pakistan floods (e.g. Khailani and Perera 2013; Liao 2012), or more general considerations about urban planning in relation to disasters (e.g. Malalgoda *et al.* 2013) or the social components (e.g. social network, participatory planning) that are important in building urban resilience to disaster (Smith *et al.* 2011; Wardekker *et al.* 2010). Although not exclusively on Asia – presented as the 'epicenter of the current urbanization surge' (Shaw *et al.* 2009: 101) – a large part of the work in this thread does focus on this region of the world, where the occurrence of climate-related extreme events is noticeable.

Logically, the underlying narrative of this thread is the increasing number of threats posed by climate-related events, and the likely vulnerability to these within cities and urban centres that are at the bottom of the social ladder: 'It is predicted that the severity and frequency of climate change induced disasters will increase and those who have the least to cope with would be the most vulnerable' (Shaw *et al.* 2009: 104). In that context, cities in developing countries are recognised to be at particular risk from climate hazards for a number of reasons (Bull-Kamanga *et al.* 2003; Lavell *et al.* 2003):

- High-density populations;
- Large sections of the urban population live in informal housing that is not regulated by land use controls and building standards;
- Concentrations of solid and liquid wastes;
- Large, impermeable surfaces and concentrations of buildings, which disrupt natural drainage channels;
- Urban expansion on particularly risky sites. (Tanner *et al*. 2009: 17).

An engineering vision of resilience

Not surprisingly, the concept of resilience in this thread (although it remains somewhat contested – see below) is broadly interpreted as referring to the ability of a system to persist and adapt in the face of climate shocks and stresses. There is in particular a tendency to emphasise the importance of infrastructure and physical elements, and the ability to resist shocks. As explained by Malalgoda *et al.*, attention is drawn to:

> physical systems [such] as built roads, buildings, infrastructure, communications, and energy facilities as well as waterways, soils, topography, geology, and other natural systems. The physical systems act as the body of the city, and at a time of a disaster, the physical systems should be able to withstand its effects under extreme stresses. (Malalgoda *et al.* 2013: 75)

In that context a critical part of resilience is related to the robustness of the system and, as expected, several definitions of resilience reflect this emphasis: 'Resilience is a measure of [the] robustness and buffering capacity of the system to changing conditions' (Agudelo-Vera *et al.* 2012: 3).

> In many cases, resilience is taken to mean exclusively the capacity to bounce back to the predisaster state …In flood hazard management… resilience is the rate of return from a flood-impacted state to the normal one (De Bruijn 2004)... Recovery is often interpreted as returning to predisaster conditions, implicitly assuming an optimal reference state
> (Liao 2012: 3)

Under this interpretation, a resilient city is:

> a city that has developed the systems and capacities to be able to absorb future shocks and stresses over time so as to still maintain essentially the same functions, structure, systems, and identity, while at the same time working to mitigate the present causes of future shocks and stresses.
> (Resilientcity.org 2010)

Indeed, the idea is that '[m]any disasters could be avoided by way of good housing, infrastructure and services; being equipped with the necessary resources and being capable of organising itself before, during and after a hazard' (Malalgoda *et al.* 2013: 75–6).

In this urban hazard and disaster risk reduction approach, the key characteristics of resilience focus on the recovery process, where the preoccupation is the stability/equilibrium

of the system. This engineering vision of what resilience is about can be summed up by the following series of keywords:
infrastructure/buffering/resistance/protection/recovery/equilibrium (see Figure 3.3, bottom left).

This interpretation of urban resilience in the context of climate change and disaster is, however, increasingly challenged (from inside and outside) by authors who claim that resilience involves much more than simply rebuilding and that physical infrastructures are not everything. Campanella, for instance, reflecting on the experience of New Orleans argues that:

> cities are more than the sum of their buildings. They are also thick concatenations of social and cultural matter, and it is often this that endows a place with its defining essence and identity. It is one thing for a city's buildings to be reduced to rubble; it is much worse for a city's communal institutions and social fabric to be torn apart as well. To enable total recovery, familial, social, and religious networks of survivors and evacuees must be reconnected.
> (Campanella 2006: 142)

Another line of internal criticisms emerges from scholars (for instance, Liao 2012) who (drawing on the ecological interpretation of resilience and in particular Holling's (1973) work), argue that even from a physical/infrastructure perspective resilience is not about equilibrium and stability, but about non-equilibrium and flexibility. In the case of flood, for instance, resilience to flood should not be interpreted as the ability to avoid flood, but instead as the ability to live with flood. Some argue that this ecological interpretation of resilience is more useful for urban planning and design because it is more dynamic and evolutionary. Under this non-equilibrium paradigm, resilience is the ability of a system to adapt and adjust to changing internal or external processes. The emphasis is not on reaching or maintaining a certain endpoint or terminal condition, but on staying 'in the game' (Picket *et al.* 2004: 373)

Urban ecological resilience

Cities as unsustainable entities

Moving away from the static/equilibrium angle and up along the left hand side of the resilience triangle on Figure 3.3, we find the second major school of thought on urban resilience, one that promotes the urban ecological dimension of resilience.

The urban ecological resilience literature, which draws on and extends traditional notions of ecosystems resilience, has an almost antagonist interpretation to the urban hazard and disaster risk reduction vision, regarding (1) what the issues are, and therefore (2) what the solutions should be, when it comes to urban resilience.

For the academics belonging to this urban ecological resilience school, the main source of concern is the impact that the rate of urbanisation has on ecosystems, biodiversity, and natural cycles. For them, the current pace of global change is unprecedented. Considering the current level and rate of urbanisation and growing ecological footprints, the impact of inadequate urban resource management has become a global issue. Some of these global issues are the rapidly declining availability of resources such as oil, fresh water, phosphorus, metals; and the disruption of natural cycles, for instance the nitrogen and carbon cycles (Boyle *et al*. 2010; Gordon, Bertram and Graedel 2006; Rockström *et al.* 2009).

In other words, the narrative underlying this approach is that cities are unsustainable and are threatening our ecological environment. As explained by Agudelo-Vera and her colleagues:

> The root of the current urban unsustainability is the massive resource consumption and waste production beyond natural supply and recycling limits … Therefore, cities

> worldwide are facing the challenge to find and implement alternative strategies (Cola *et al.*, 2005) towards more sustainable management of urban resources.
> (Agudelo-Vera *et al.* 2012: 3)

Several ecological footprint studies estimate, for instance, that cities greatly exceed, or overshoot, their bio-capacities typically 15–150 times over (Doughty and Hammond 2004). Cities are not sustainable because they do not use resources efficiently. In general, cities have a linear usage of resources and waste production, without feedbacks of resources in terms of quantity and quality (Leduc *et al.* 2009).

Others are not as much concerned by the level of waste as they are by the impact of cities on biodiversity and ecosystems, and the degraded capacity of these ecosystems to deliver their different services. 'While cultural diversity is increasing in cities at a global level as a result of urbanization, biodiversity is decreasing with a subsequent loss of ecosystem services' (Colding and Barthel 2013: 156). In these conditions the benefits that urban inhabitants and cities derive from ecosystem processes including, for instance, improved water and air quality, storm protection, flood mitigation, sewage treatment, micro-climate regulation, and recreation and health values are being jeopardised or even irreversibly damaged (Ernston *et al.* 2010).

Urban resilience essentially viewed as an ecological concept

Resilience here is therefore closely related to ecological processes and dynamics, and is therefore defined in line with this ecological focus: Resilience 'is used here as the capacity of an ecosystem to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity and feedbacks (Colding 2007: 46); see also Jansson and Polasky (2010), Jansson (2013), or Colding and Barthel (2013) for similar definitions. In fact, some scholars even go as far as stating that resilience was at its origin an ecological concept, and that is part of the reason why urban resilience has so far been neglected:

> *given its origins in ecology*, it is not surprising that most resilience scholars have historically been interested in empirical analyses of non-urban areas (e.g., shallow lakes, production forests, and small-scale agriculture, see Berkes and Folke 1998; Gunderson and Holling 2001; Berkes *et al.* 2003), and have devoted less attention to the specifically human and social elements of human-dominated systems, such as cities.
> (Ernston *et al.* 2010: 533, our emphasis)

Some authors go as far as talking about 'ecological resilience of urban ecosystems' (Alberti and Marzluff 2004: 241).

This vision of resilience as being a fundamentally ecological concept is relatively narrow and seems to ignore a large part of the literature on resilience, but it illustrates relatively clearly some elements of the narratives adopted by this school of thought: 'cities are unsustainable and have been lacking ecological resilience, we need therefore to "inject" more resilience into these cities to make them more resilient'. How do we do that? First by promoting the conservation or the restoration of urban biodiversity: 'There is increasing scientific evidence on the essential role of biodiversity for building resilience in a changing world' (Jansson 2013: 286). 'Biodiversity along with social, physical, and economic diversity, are important and effective strategies to support urban resilience' (Ahern 2011: 342). The argument here is that biodiversity can play the role of 'insurance' against risk and shock:

> with a greater number of species performing a similar function, the ecosystem services provided by any functional group – for example, the decomposers – are

> more likely to be sustained over a wider range of conditions, and the system will have a greater capacity to recover from disturbance.
> (Ahern 2011: 342)

In this part of the narrative, management of diversity is considered to be a key attribute for building resilience. Diversity spreads risks and creates buffers (Berkes *et al.* 2003). As such, diversity is seen as key for dealing with disturbance and change in productive ways, with self-organisation and the capacity for learning and adaptation constituting important resilience characteristics. In sum, the key characteristics that are emphasised in this ecological urban resilience are: (bio)-diversity; diversification; (urban) ecosystem services.

Beyond the ecological interpretation of urban resilience

As with the disaster risk reduction literature, the interpretation of ecological urban resilience has also evolved over time. From a strong and narrow focus on urban-based ecosystems (e.g. Alberti and Marzluff (2004); Jansson and Polasky (2010)), it has progressively moved to a more integrated analysis of urban-coupled human–environment systems (Pickett *et al.* 2004), and examination of cities and urban networks as complex adaptive systems (Resilience Alliance 2007). Within this literature, the promotion of urban green commons (UGCs) is illustrative of this recent effort to better integrate social and ecological dynamics. Some would have seen in these UGCs the continuation of the predominance of ecology in this urban resilience narrative. Yet, the emergence of UGCs in the literature was based on their ability, as common property systems, to stimulate and promote some degree of environmental stewardship and social-ecological memory, which in itself was seen as promoting urban resilience (Colding and Barthel 2013). Similarly, urban and peri-urban agriculture (UPA), which also emerges in this literature, is praised not only for its ecological properties (such as (1) maintaining green open spaces and enhancing vegetation cover in the city, or (2) reducing energy use and greenhouse gas emissions by producing fresh food close to the city) as a way of 're-greening' cities, but also for its social 'properties' including:

- poverty alleviation and social inclusion;
- urban food and nutrition security;
- reducing the vulnerability of specific groups (de Zeeuw *et al.* 2011).

Urban resilience through governance and institutions

The need to address uncertainty

The third main thread in this urban resilience literature is 'urban resilience through governance and institution'. In this thread, the analysis is focused on questions of how different types of institutional arrangements (e.g. participatory planning) and governance systems (e.g. decentralised governance) affect the resilience of cities (e.g. Tyler and Moench 2012) and how in turn resilience thinking can influence the development of improved governance mechanisms for promoting effective disaster risk management and adaptation to climate change (see for example, Evans (2011); Pelling and Manuel-Navarrete (2011); Wallace *et al.* (2007)). This includes, in particular, studies on how resilience principles such as adaptive management can be used in exposed coastal areas (Wardekker *et al.* 2010) and which characteristics of urban governance can enhance climate resilience while at the same time reducing the vulnerability of urban citizens who are most at risk of climate-related shocks and stress (Tanner *et al.* 2009).

The narrative is one where cities are described as facing uncertainty and increasing unsustainable conditions and challenges and will need to 'navigate' the necessary changes and transitions:

> we are facing an increasing uncertainty due to climate change, migration of people, and changes in the capacity of ecosystems to generate goods and services. In an

> urban context, this means that the traditional paradigm of planning for a predictable future is not only insufficient, but it may, in some ways, also be destructive. This article strives to lay a foundation for transitions in urban planning and governance, which enable cities to navigate change, build capacity to withstand shocks, and locate sources of experimentation and innovation in face of uncertainty.
> (Ernston *et al.* 2010: 531).

Underlying this is the 'inevitability of climate change', that is the recognition that because of climate change we don't have any choice but to learn how to adapt and to adopt an adaptive governance: 'climate change is reinvigorating a need to "cultivate new techniques of governance" for urban sustainability… The inevitability of climate change is turning attention increasingly to the question of adaptation' (Evans 2011: 223).

The social and governance dimensions of resilience

In these conditions the meta-principles that are necessary to ensure the resilience of the system are flexibility, self-organisation or creativity: 'Diversity is thus seen as key for dealing with disturbance and change in productive ways, with self-organization and the capacity for learning and adaptation constituting important resilience characteristics' (Colding and Barthel 2013: 156–7). For Gleeson (2008: 2657) the imperative for this flexibility is 'the continuous task of adaptation that must maintain the resilience of the urban system… [and] the interplay of evolution and adaptation (policy) (Gleeson 2008: 2658). Similarly Ahern (2011) proposes that some of the many characteristics of urban governance that are identified as promoting resilience should include: polycentricity, transparency and accountability, flexibility, and inclusiveness.

Baud and Hordijk's 2009 paper represents a good example of this literature. In their paper these authors discuss the main characteristics of resilience thinking and adaptive governance, focusing on those features relevant to urban planning in the context of uncertainty, unpredictability and change. According to them, these characteristics include: flexible institutions, knowledge systems that integrate different sets of knowledge, the capacities of learning by experiment, creativity, and self-organisation. In a subsequent paragraph they contrast these characteristics of adaptive governance with current situations, and conclude that a number of recent trends in urban governance – decentralisation, the shift from government to governance and increased citizen participation – should in principle allow for more adaptive governance models, as they support (in theory) greater flexibility and autonomy at the local level.

Yet, Tanner and his colleagues (2009) point out that, in some cases, the decentralisation of decision-making and political control can create conflicts and delays between agencies, hampering the development of climate-resilient programming. In other circumstances heavily top-down decision-making structures can help to implement programmes quickly, even if they often fail to allow participation of those people they are designed to help. In that regard, the quality of government at the local level has still a potentially greater impact on climate risk. Municipal governments are responsible for decisions on the quality and provision of infrastructure, disaster preparedness and disaster response, and city planning development (that is, preventing new development in areas of high risk or not protecting areas that allow for buffer zones). Yet, recent evidence suggests that many municipal governments do not have adequate provisions in order to deal with increased climate hazards such as flood management. In well governed cities,

> good provision for storm and surface drainage can easily be built into the urban fabric, along with complementary measures to protect flooding. But in poorly governed cities this does not happen – and it is common for buildings and infrastructure to be constructed in ways that actually disrupt drainage channels.
> (Tanner *et al.* 2009)

The latest observations lead some to conclude that urban resilience depends on the social and governance dimension, rather than on technical or ecological factors. Ernston and his colleagues (2011), for instance, believe that:

> sustainability and resilience depend on a society's innovative capacity [and that] solutions must be found by innovating in urban systems at different scales and across sectors. This firmly frames the urban system as an opportunity for sustainability and drives us to recognize that the answer to increased resilience might not lie in its ecological dimension, but rather in the social.
> (Ernston *et al.* 2011: 538)

Reflecting on water management issues in the urban context, Rijke *et al.* come to the same conclusion: 'Developing resilient water resource management systems is more a governance issue than a technological issue' (Rijke *et al.* 2013: 63). To some extent this resonates well with Adger and his co-authors when they argue that: 'adaptation to climate change is limited by the values, perceptions, processes and power structures within society' (Adger *et al.* 2009: 349).

The importance of multilevel governance

Finally, the literature on governance in the urban context also highlights the importance of multilevel (or polycentric) governance systems, which are considered crucial for enhancing resilience (Huitema *et al.* 2009; van de Meene, Brown and Farrelly 2011). In a multilevel governance system, decision-making is dispersed across multiple centres of authority (Hooghe and Marks 2003). As such, it is the outcome of interaction between public sector agencies, private sector organisations and the community. Multilevel governance enables knowledge exchange and mutual adjustment of governance at different levels and sectors of governance (Agrawal 2003) and potentially leads to synergetic effects (Ostrom and Cox 2010) that enable more adaptive governance regimes (Armitage, Berkes and Doubleday 2007). Furthermore, multilevel governance relies on a mix of formal institutions and informal networks (Olsson *et al.* 2006; Tompkins and Adger 2004), and it is recognised that it is critically important to account for these in the urban context in developing countries.

4 Foresight exercise

4.1 What is a foresight exercise?

Foresight exercises (FE) are based on the premise that imaginative yet systematic assessments can assist urban planners, decision-makers and communities in exploring possibilities and scenarios for the future. FE are increasingly used by urban literature scholars and by planners and decision-makers in cities around the world to develop strategies, visions and plans in attempts to help urban territory entities tackle their present problems and ensure adequate development in years to come.

Although it has gained popularity among both practitioners and scholars, no standard definition of 'foresight' has been established yet, even if textbooks and manuals often refer to two definitions. The most often quoted stems from Martin (1995, quoted in Hartmann 2011), who describes research foresight as:

> the process involved in systematically attempting to look into the longer-term future of science, technology, the economy and society with the aim of identifying the areas of strategic research and the emerging generic technologies likely to yield the greatest economic and social benefits.
> (Martin 1995, quoted in Hartmann 2011: 335)

Similarly, Georghiou (1996) describes technology foresight as 'a systematic means of assessing those scientific and technological developments which could have a strong impact on industrial competitiveness, wealth creation and quality of life' (quoted in Hartmann 2011: 335).

The increased interest in foresight has been triggered by several factors. First is the extensive and rapid transformation of both local and global environments, which poses new challenges for urban planners and governments. The second is the recognition that current planning methods are less and less effective in dealing with these challenges (Krawczyk and Ratcliffe nd).

Foresight exercises, along with forecasting techniques and other futures approaches are used as tools to systematically develop or adjust strategic plans. They are used to:

- support decision-making and provide both quantitative and qualitative input to strategic decisions for investments or actions;
- stir new ideas, identify opportunities and provide information on possible new markets, policy measures, or other activities;
- increase anticipatory intelligence and provide information on future developments, thereby helping to identify possible actions that can be reflected against, to increase the insight of their future context (Hartmann 2011).

In both Mumbai and Khulna, these questions are addressed with a particular emphasis on how the political and spatial economies relate. We also, in particular, tease out the dynamics of urban and peri-urban expansion.

4.2 Methods

Many different approaches and techniques have been developed and are available in the literature to conduct foresight exercises. In this project we relied on a combination of three complementary methods – a STEEP analysis, a scenario analysis and a wind-tunnelling analysis, see Sections 4.2.1, 4.2.2 and 4.2.3. A two-day workshop was convened on 14–15 November 2013, in which a group of 12 urban experts from both inside and outside the

project team were invited to participate, under the technical guidance of a professional external foresight expert. Using both the material provided by the two case studies (Mumbai and Khulna) and the results of the narrative analysis, as well as their own individual experiences, the experts were invited to contribute to the different elements of the FE.

4.2.1 STEEP analysis

STEEP (Societal, Technological, Economic, Environmental and Political) is an exploratory technique that is often used as the basis for onward futures activities and discussions. It was developed to encourage wide scanning of drivers of change in the external environment relevant to a research question or policy issue. External processes are those that are acting on, or influencing a situation (Foresight 2009). STEEP is often used as a preparatory step for scenario analysis.

In our case, the two case studies (Mumbai and Khulna) were analysed using the STEEP process to identify the drivers (factors) of change that had influenced their development. Using material prepared by the team, the group of experts identified the different drivers that affect urbanisation, drawing on their understanding of the processes that influence and shape urbanisation processes in the global South. The group was then encouraged to suggest *future* drivers of change in the context in which Mumbai and Khulna would develop. Building on the findings of this initial STEEP analysis, the group then developed a set of scenarios.

4.2.2 Scenario analysis

Scenarios are a way to structure, think about, and plan for, future uncertainties. Scenario analysis requires the articulation of more than one possible future (typically three or four). Scenarios do not predict the future. Rather they provide the means to consider today's policies and decision-making processes in light of potential future developments. A number of analytic tools can be used after completing the scenarios to test the robustness of individual policies, or of the scenarios themselves. In our case we used a wind-tunnelling analysis (see Section 4.2.3).

Usually the construction of a scenario would involve the identification of drivers (through, for example, a STEEP analysis), the identification of scenario axes (usually two, which should be independent of each other), and the elaboration of four subsequent scenarios.

The factors chosen for the axes should be 'high-impact, high-uncertainty', to ensure that the four spaces defined by their intersection are clearly differentiated. These spaces are then developed into scenario narratives, reflecting the influence of other events and trends in addition to those represented on the two axes. The scenarios generated using the 'two axes' process are illustrative rather than predictive; they are expected to be high-level (although additional layers of detail can subsequently be added) and as such are particularly suited to testing medium- to long-term policy direction. Scenarios developed with this method tend to look forward 10–30 years.

4.2.3 Wind-tunnelling

The term 'wind-tunnelling' refers to the process in aerodynamic research that consists of analysing the effects of air moving past solid objects. By analogy, a wind-tunnelling analysis in an FE context refers to the process that is used after completing the scenarios to test existing or potential policies against the different scenarios. It does this by considering how the external conditions described in each scenario would affect the success of the policy in question. Wind-tunnelling can help check the robustness of policies (those successful in all or most of the scenarios), and also help identify critical planning points where strategy needs to be flexible and adaptable. As such, wind-tunnelling is generally viewed as a good public sector technique for policy testing.

4.3 Linking the case studies to the foresight exercise

The detailed discussion of the two case studies is presented in two separate reports on Mumbai and Khulna. In this section we provide a short description of these two cases as they were presented during the two-day workshop. The information was organised around two questions that were provided to ensure the effective link between the two case studies and the FE:

1. What past drivers, processes, and forces have been important in bringing these two cities to where they are now?
2. What are the recent/current policy frameworks that have been proposed in relation to these two cities (in response to date to these drivers, processes, and forces)?

4.3.1 Mumbai

General background

The story of Mumbai started with a collection of seven islands that were joined together by reclaiming land from the Arabian Sea and surrounding mangroves. From being a 68km^2 walled city in colonial India, today Greater Mumbai encompasses a total area of 437km^2 (MCGM 2013) and the urban agglomeration of the Mumbai Metropolitan Region (MMR) covers a total official area of 4,355km^2. All these additions to the official jurisdiction of the urban region have happened in the post-independence era – that is, over a period of 60 years. Growth, however, has not been uniform across the city. As the most recent census figures indicate, the 'island' districts (Inner Mumbai) actually lost population between 2001 and 2011, while all growth was in suburban areas outside the historic core. Since the early 1980s, Inner Mumbai has lost 140,000 residents, while suburban areas gained 13.2 million. Three distinct stages in Mumbai's growth can be described as: (1) population growth concentrated in Inner Mumbai until 1960; (2) population growth shifts to Outer Mumbai between 1960 and 1980; and (3) Thane, a small satellite city, emerges as virtually equal to Outer Mumbai in its share of growth and has continued to dominate since the early 1990s. Mumbai is therefore illustrative of rapid urbanisation and urban expansion in developing countries. Mumbai today is the financial hub of India and rapidly expanding and marked by deep inequalities.

Past drivers

This rapid growth has been driven by key factors such as modernisation, industrialisation and migration. However, the factors that make Mumbai stand out are the dynamic influences that various sociopolitical and economic factors had on these drivers. Economically and in terms of planned infrastructural development, the seeds for unequal development were sown during the colonial period as regions beyond the walled city were seen as reservoirs of resources and labour while being excluded from government provisions and planning for urban infrastructure. The segregation between the planned walled and the unplanned 'outer' city (often referred to as 'Black Town' in colonial discourse) came to be further reinforced during the rebuilding efforts after the Great Fire of 1803, and subsequently in the mid-1800s, when the Committee on the Future Extension of the City of Bombay directed trades that 'caused danger or offence to the public', like tanning, catgut-making, fat-boiling and indigo dying, for example, to be moved outside of the Fort walls. This meant that in the decades following the outbreak of the Bombay plague epidemic in the late 1800s and early 1900s, communities settling outside of the walled city organically developed methods of service provision that were beyond 'formal' realms.

Politically, the creation of the Indian National Congress, the rise of labour movements and working-class action under the communist leadership, reflected the growing socioeconomic and ethnic polarisation in the city (Chandavarker 1998). However, the collision of the pre-

industrial characteristics of the working classes and their traditional loyalties with 'Western' rationality of the industrial context obstructed the development of 'modern' trade unions. The complex mix of patronage and politics thus created only intensified in the post-independence years due to the 'saffronisation' (2010) of Mumbai's politics, with the rise of the Hindu right-wing party 'Shiv Sena' quashing the radical urban agendas of left-wing workers, intellectuals, and activists. As saffron displaced red, it fashioned and entrenched an urban political culture of populism that divided society into two rival camps – the 'people' and their 'enemies' (Prakash 2010). Since colonial times, rural migrants have thronged to Bombay/Mumbai in search of employment.

Policy frameworks

As Greater Mumbai struggled to keep up with the influx of migrant labour and service provision in the post-independence era, the Gadgil Committee, appointed in 1965, demarcated the Bombay Metropolitan region and prepared a regional plan with the primary objective of reducing the concentration of economic activity on Bombay Island. The plan envisioned a new multi-nucleated metropolitan region where the city centre on Bombay Island remained the focus of managerial, financial and specialised commercial activities, and industries, services and other incidental activities relocated to the mainland where a series of self-contained townships would be constructed to receive the overspill of industry and population (Phadke 2013).

The Mumbai Metropolitan Region Development Authority (MMRDA) that emerged around the 1960s played a key role in the process of planning the MMR through its efforts to incorporate the inner periphery (less than 30km from the island city) of Mumbai and the outer peripheral areas (at a distance greater than 30km) in successive decades. By the 1960s, there was also a growing realisation of the need for the 'planned and orderly' growth of Indian cities to manage their rapidly expanding population, thus was born the idea of 'New Bombay', now 'Navi Mumbai', on the outskirts of Mumbai, to play a central role in the planned decongestion of Bombay (Phadke 2013).

The current political economy of the urban development of Mumbai continues to be entangled within these historical factors; namely, institutionalised inequality, patronage politics, and the stronghold of right-wing, ethnic populism. Moreover, in terms of urban expansion, the centrality of Mumbai remains intact, even as it impoverishes its peripheries, which are only looked at as an afterthought, as subservient spaces to supply valuable human and natural resources to feed Mumbai's modern economy and to absorb the unwanted, undesirable people and activities, which Mumbai casts out. Furthermore, the first four decades in post-independence India, with strong government planning and regulation, incubated a parallel informal economy, which continues to determine the realities of the city. In Mumbai, informality is a key feature in its 'idiom' of urban development. While this idiom seems to be antithetical to planning, and indeed seems to be anti-planning, it has been argued by some that it almost emerges as a planning regime (Roy 2009). Within the realms of formal policy frameworks, current debates regarding Coastal Region Zone (CRZ) regulations, with builder lobbies on one hand and environmentalists on another, are negotiating the legality of reclamation of areas closer to the coast that can be developed. Private sector developments as well as large-scale public sector projects such as the 'Sea Link' and 'Navi Mumbai International Airport' are found to be in violation of CRZ regulations.

In terms of disaster management and risk mitigation, the state government continues to adopt solutions that are technocratic, such as trying to improve drainage systems and widen rivers. These solutions, however, fall short in addressing the needs of areas with high and ever growing population densities and built environments, as the planning of land development and that of infrastructure development are not coordinated in any systematic way. While the legal mandate requires land authorities to produce a regional plan relating to the infrastructure needs of an area before, or at least simultaneous with, a development plan,

in practice this is not the case. Land and permissions for its development are allocated to developers in haphazard ways that fall on the periphery of 'formal' or 'legal', accompanied by bribery and graft. For this reason, the carrying capacity of the technocratic solutions for drainage often fails to match up to the real needs, and requires solutions that involve deeper discussions regarding models of urban planning and development.

4.3.2 Khulna

General background

Khulna is located in the southwest of Bangladesh, and currently has a population of around 1.4 million (third largest city in the country). Already incorporated as a city under British rule in 1884, its history is bound up with that of the British Empire and its agricultural and industrial activities. Bengal (today divided between Bangladesh and West Bengal in India) was the heart of a colonial cropping system that included jute (an industrial fibre) established under British domination from the late eighteenth century. Initial processing of the crop was dominated by Dundee (in Scotland), but subsequently Bengal developed its own jute processing industry, with Khulna becoming one of three main locations (with Dhaka and Chittagong) in what is now Bangladesh (much was also located in Calcutta).

In addition, Khulna grew (largely for reasons connected to the historical drivers) in a location and with an environment that is not conducive to urban function: it is on low-lying land within the delta of the Ganges and Brahmaputra rivers, subject to floods, waterlogging and cyclones. These factors, together with disputes with India over control of water flowing into the tributaries of the Ganges, have a significant effect on water availability and quality (especially salinisation of groundwater) that makes the future of the city difficult.

Past drivers

There are three types of drivers that have legacy impacts that are still relevant today: crops and factories; land tenure systems and class power; political conflict over independence, identity and religion. Under British rule from the nineteenth century, a system of land tenure was introduced that granted revenue collection responsibilities to a class of landholder who became in effect landlords. Their tenants were sharecroppers, or, increasingly, waged farm labourers. This quasi-feudal system remains in effect today in much of Bangladesh, and affects the power relations of the Khulna area, particularly in relation to urban adaptation. As in other parts of the country, a very significant part of the rural population around Khulna are landless householders whose main livelihood is in wage labour or sharecropping. The interactions between this rural hinterland and Khulna city (and other towns and cities) are complex, relating to normal rural–urban migration and also distress migration and displacement related to extreme events (especially cyclones).

Britain's Indian empire gained independence in 1947, and as a result of the partition into two countries (India and Pakistan) on religious grounds, east Bengal became East Pakistan, with a majority Muslim population. However, in the Khulna area and in the city itself there is a minority of about 25 per cent Hindus. The religious divide (which reflects the divisions created in 1947 and reinforced after 1971) overlays the system of land tenure, power relations and access to land in both countryside and city. Khulna's links with Calcutta (now Kolkata – which is only 150km to the west) were disrupted by partition, and this affected industrial linkages. Mongla, a port 48km downstream to the south of Khulna, was established in 1954 to serve the exports of the area since access to Kolkata became more difficult.

Bangladesh gained independence from Pakistan (1971) after a devastating civil war, whose legacy is still relevant today as political rivalries that originated then are re-ignited in fighting and *hartal* (strike) protests that block roads and disrupt commercial traffic to Mongla and elsewhere. Although small by international standards, Mongla is the country's second largest port (after Chittagong), and has enabled the Khulna area to export jute, and to emerge (since

the mid-1980s) as a major producer of shrimps for export, with over 30 processing plants in the city itself. This shrimp farm industry complex (with much land in the city periphery converted to saltwater shrimp production) has significant links to the social and environmental problems of the area and the city, which are of relevance for urban adaptation. The industry is also strongly intertwined with the systems of quasi-feudal power that control use of land, with tenant and wage labour farmers losing out because of the conversion to shrimp production.

Policy frameworks

Khulna city boundaries are formalised under the Khulna City Corporation (KCC), set up when the city was incorporated in 1984. This legacy is a severe handicap to effective urban planning and therefore also to adaptation, since much of the urban expansion has taken place beyond the city boundary. In addition to KCC, Khulna is influenced by the separate Khulna Development Authority (KDA) that is charged with 'planned development and expansion of Khulna city and its suburb areas' and operates under a different ministry, of Housing and Public Works.

The peri-urban zone is especially threatened by the inadequacy of regulation, and conflict and rivalry between these two institutions, and the absence of a proper planning authority for the greater Khulna area. The KDA is very aware of the inadequacy of its remit, which makes its strategic plan (2001–2020) difficult to implement. For instance, the emergence of a largely commercially driven Khulna 'growth corridor' stretching from Jessore town (80km to the north) through Noapara and Khulna and potentially to Mongla is lacking significant planning as much falls outside the KDA area.

The city may be influenced to some extent by the government's Integrated Coastal Zone Management policy, which has limited proposals for the city (for example, sewage treatment). But the city may benefit from improvements to the protection of the coast against storm surges and floods, which may reduce the problem of groundwater salinity. However, policy frameworks required to deal with the urban flooding and waterlogging may be negated by natural processes (the city is estimated to be subsiding by nearly 1cm per annum) and the upstream control of rivers in India, which affects the dry season flow and worsens salinisation of the lower delta.

4.4 Driver (STEEP) analysis

In line with our review of the literature, a primary theme emerging from the STEEP analysis was that urban development, and peri-urban expansion in particular, in both case study cities has been deeply influenced by economic and political actors, agents and processes, which have demonstrated their influence at various levels, and over long periods of time (these can be viewed as pathways of influence between columns and rows in Table 4.1). Despite the stark differences in absolute size and the stage of urbanisation, several drivers of change identified in contemporary Khulna and Mumbai continue to display colonial remnants. These were shaped, for example, by the location of industry and manufacturing processes (of jute in Khulna and cotton in Mumbai) that involved particular power-sharing arrangements between colonial, regional and local agents. Importantly, these actors and agents of influence were located in both the urban centres and the surrounding rural landscapes, highlighting the long-running interconnectedness of the urban, peri-urban and rural areas. National and city-level government planning bodies have continually attempted to influence and manage peri-urban expansion, but this has been limited primarily due to the lack of capacity. Regional dynamics of land use patterns, large-scale demographic shifts and profit-seeking business interests appear to have had a much more significant impact on peri-urban expansion than government-led efforts, which have been more successful in influencing the city centres. As witnessed particularly in contemporary Mumbai, the areas considered to be 'peri-urban' are rapidly becoming the primary areas of urban activity, accounting for a majority of the

population and spatial area. Other important dynamics shaping where and how the cities have expanded include economic and (ethnic) identity-based segregation on the one hand, and organisations/collectives of workers and of the urban poor laying claim to parts of the city, on the other.

Building on the material presented during the two oral presentations, the group of experts was then asked to identify more broadly the different key drivers of urbanisation that they thought were relevant for the analysis, using the STEEP framework. Table 4.1 summarises the results of this brainstorming. In that particular case, the initial series of key drivers identified by the experts have been grouped into 'clusters'. Not too surprisingly, these clusters of key drivers covered the five categories: social, technology, economy, environment, and political, but not necessarily with the same apparent level of thoroughness. In particular, the analysis suggests that amongst these categories, economic and political drivers seem to be more numerous than social and technological drivers. Column headings in the table describe a framework of macro-environmental factors guiding the horizon-scanning exercise, and we found these factors to vary in importance depending on particular case studies or scenarios. It was also possible to think about interconnections between individual cells across or within columns in the table. For some sets of cells, these interconnections reflect a temporal sequencing, where one key driver would likely lead to, or contribute to another (for example, extreme environmental events or stresses on essential resources like water might trigger economic crisis and/or urban tensions, or alternatively, they might incentivise markets to move towards greener technology). For other sets, the interconnections reflect a two-way relationship, where key drivers would most likely coexist (for example, the advent of green technology and innovation might spur overseas investment, or vice versa). Alternatively, particular drivers might preclude others (for example, ethnic/regional political standoffs may preclude or strain resource-sharing arrangements, or the short-term successes of profit-seeking behaviour may thwart longer-term innovation). The clusters which were more specifically related to the two case studies are indicated in italic.

4.5 Scenario analysis

Building on the driver (STEEP) analysis, the group of participants were then asked to identify two potential axes which could be used to 'divide' the space of future possibilities into four contrasting scenarios. These scenarios needed to be:

- plausible;
- internally consistent;
- based on rigorous analysis;
- engaging and compelling.

4.5.1 Identifying the axes

The factors identified for the axes needed also (1) to be chosen so that the four spaces defined by their intersection would be clearly differentiated, and (2) have some resonance with respect to the peri-urban discussion that constitutes the core of the overall project. On the basis of these different criteria and after discussion, two axes were chosen for the scenario analysis:

1. the quality of economic growth;
2. the degree of subsidiarity of governance.

Table 4.1 STEEP analysis. Clusters of key drivers (in no particular order) as identified by the experts. In *italic* are key drivers specific to the two case studies (Mumbai and Khulna)

Social	**Technology**	**Economy**	**Environment**	**Political**
Urban (in)security tensions	Green technology	'Big Business' (profit-seeking)	Extreme events	Regulatory and legal instruments on land, water, housing
Security	Innovation – technological breakthrough on food, transport, water technology	*Growth – economic activity (BRICS)*	Climate change (shock and trends, e.g. sea-level rise)	Water-sharing between countries
Family Structure	Agricultural system changes	Global trade dynamics	Water quality/ water stress	Regulations and politics (e.g. agricultural policies)
Rural Impoverishment and displacement/ migration	Resource extraction/capture	Overseas investment	*Riverbank erosion*	Ethnic/regional politics (e.g. against migration)
Social network/capital (Information-sharing)		Land market (construction, infrastructure)	Spatial/ physical attributes	Local institutional behaviour (local profit-seeking)
		Level of control over capital (wealth/capital distribution)		Political stability
		Economic crisis		*Changing India–Bangladesh relations*
		Middle-class demographics		Governance arrangements/shifts in authority (also legislation)
		Economic performance		National/international discourses around urbanisation
		Infrastructure investment (e.g. port)		Land laws and enforcements
		Infrastructural investment/development (airport and sea link)		
		Foreign investment		
		International demand (e.g. for prawns)		
		Trade competition		
		Loss of farm productivity Special economic zones		

Axis 1: Quality of growth

A large number of the clusters of drivers identified were economic in nature, reflecting the (accepted) reality that economic processes are having an important impact on urbanisation. After all, cities and urban centres are now recognised as key drivers of economies, and the larger share of national GDP is now created in cities (UN-Habitat 2011). In addition, and despite the fact that they were not trying to capture every single aspect and dimension of societal issues within this axis, the workshop participants also recognised that the level of

growth (high/low) was not in itself enough to encompass the current debate about this driver. They therefore also included in this axis the degree of inclusion of this growth ('to what extent does this growth benefit the poor?'), and the level of 'environmental friendliness' of that growth, recognising that now (and especially in the future) this growth will have to be green, thus linking this to some degree to technological innovation/transformation. This also relates to the previous discussion about different concepts of resilience, and responds to notions of the urban as non-viable. Axis 1 is therefore an axis describing at one end a world where societies continue the business-as-usual approach (non-green, excluding growth, leading to increasing economic inequalities), and at the other end a world where societies have managed to take a fundamental and transformative turn, leading this growth to become greener and more inclusive.

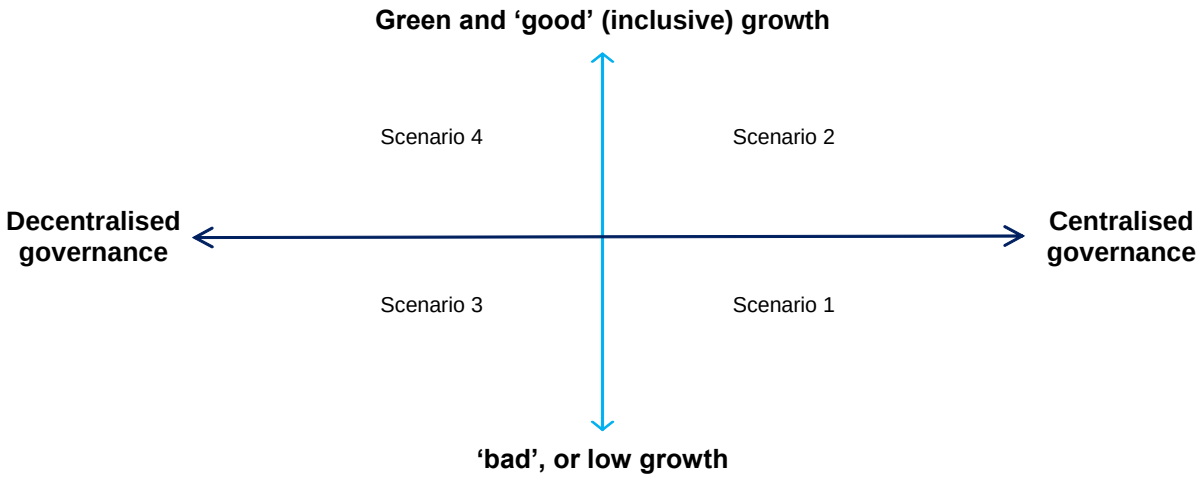
Axis 2: The degree of subsidiarity of governance

The second axis also builds on the driver analysis and the fact that the second major group of drivers identified through the STEEP process were 'political drivers'. This reflects the other (well accepted) reality that power and politics are key factors shaping development processes in general and urbanisation in particular. Along this axis, the participants considered that a relevant determining factor (from the peri-urban perspective) was the level of decentralisation of the governance system. The axis therefore runs from one end characterised by a situation where power, resources and decision-making processes are concentrated in the hands of a strong centralised authority. This authority comprises both high-level central government and authorities of the capital/megacities, and possibly some powerful private actors. At the other end of the spectrum, power and responsibilities are more devolved to lower, decentralised entities, be they local governments and communal entities, or even citizens through representative groups.

Figure 4.1 represents the two axes together. These define four different scenario quadrants:

1. Scenario 1: 'Bad' or low growth in a centralised governance system
2. Scenario 2: 'Good', green growth in a centralised governance system
3. Scenario 3: 'Bad' or low growth in a decentralised governance system
4. Scenario 4: 'Good', green growth in a decentralised governance system

Figure 4.1 The two axes ('growth' and 'governance') used for the scenario analysis



4.5.2 Unfolding the scenarios

Scenario 1: 'Bad' or low growth in a centralised governance system

Under scenario 1, in the 'core cities', that is, the capital where the central government is established, and possibly in some megacities across the country (such as Mumbai perhaps), we can expect to see some large infrastructure projects developed through partnership between bureaucrats and large developers. The central government invests in these because it is assumed that the success of the city depends heavily on economic growth, conventionally defined, and on successful revenue-raising, possibly involving the central state capturing increasing land values but more generally through deals with large developers. On this basis, heavy investments are taking place in the core city and in key infrastructure projects such as ports and international airports – but financed through deals with developers. National urban development programmes focus on turning cities into economic growth machines, and removing 'slums' through developer-led 'regeneration'. In practice, slum populations are forced out to the periphery. The core cities are superficially 'clean and green', though this is only achieved through their relations with the peripheries.

At the periphery (in particular in the peri-urban areas), the situation contrasts sharply with the core cities. Dirty, polluting, large industries and lower-income populations that have been banned by 'environmental' regulations and expelled economically from the core cities are established in these periphery areas. Population growth rates and poverty prevalence are high. The peri-urban mosaics are beset by a range of environmental problems (see below), helping to keep land prices down, making it more affordable for business, and low-income migrants from the countryside/other cities. A few rich and successful entrepreneurs are also living behind the high walls of gated resorts in some of the remaining preserved and quieter green parts of the peri-urban areas. Next to these, large informal settlements are mushrooming, as a result of rural migration and pauperised urban working classes attracted to the margin of the core cities where economic opportunities are created. Key networks of roads/railways are extended to the core urban population and to satellite towns but the periphery remains poorly served in terms of water sewerage, electricity and public transport. Huge numbers of commuters – leading to an increase in transport – generate greenhouse gas emissions. Water demand increases (both in the core and on the periphery – but under different dynamics: high consumption per capita in the core versus growing population in the periphery) and water resources are increasingly drawn from more distant watersheds. Groundwater quality declines.

Scenario 2: 'Good', green growth in a centralised governance system

Under scenario 2, the dominance of the central government and core cities over economic and political systems and decisions is not expected to diverge from those observed under scenario 1. But the general orientation of these decisions has shifted away from the business-as-usual approach supported by the current growth discourse, towards a greener, more environmentally and socially responsible discourse. Strong, prescriptive regulations will limit/reduce the polluting activities and unsustainable investments. The core cities are now increasingly green and 'liveable', thanks to large investments made by the central government and the authorities of the core cities in sustainable infrastructures (transport, energy). While a large part of the overall resources are still monopolised and restricted to the core, people at the periphery benefit indirectly and through 'spillover' and 'trickle-down' effects. The people in these periphery (including peri-urban) areas are doing better than under scenario 1. Poverty levels are dropping – yet peri-urban households are still under-counted/under-represented. Livelihood opportunities are being created but demand is driven by the capital and core cities. Livelihood patterns are likely to change, but this will happen essentially as a result of the 'vision' of the central authority and regardless of the actual needs/preferences of the peri-urban populations.

A growing middle class commutes from the periphery to the core/centre of cities where most of the economic activities and jobs are still found. So the environmental costs may be reduced in comparison to scenario 1, but not necessarily the social costs. The core also prices out these middle/lower classes. In summary, while there is no technical limitation in terms of growth or green/sustainable technologies, these peripheries remain politically and economically marginalised in a system where a small number of powerful actors (from both the public and private sector) are controlling the socioeconomic, political and environmental resources. In that context we are likely to see the continuation of land/water grabbing (processes controlled by city centres) to the detriment of the periphery and rural areas. Environmental quality is expected to improve overall, but will not necessarily be enjoyed by the peri-urban commuters.

Scenario 3: 'Bad' or low growth in a decentralised governance system

Under scenario 3 the core city loses economic and political power to the periphery area and its population, but the economic growth model remains similar to that of scenario 1: industrialisation along a 'high-carbon trajectory', with expansion of fossil fuel consumption, including air freight, and inefficient technologies – 'dirty growth', in short. It means high economic, social, and environmental costs – more slums, water stress, and congested traffic, for instance.

In the case of Khulna, the scenario was developed according to a lower growth hypothesis. This low-growth scenario was considered more likely than a higher dirty growth in view of the global uncertainties that could affect Bangladesh's export of garments, jute, leather and seafood, and the remittance prospects of its migrants. Comparatively lower levels of investment in industries and infrastructure in the southern areas – which includes Khulna – also reinforces this hypothesis of a low-growth scenario.

A low-growth scenario would slow down industrialisation and urbanisation processes. Outside the core cities this would hinder progress and in particular prevent the periphery becoming integrated into the global economy. Growth would be inhibited in general through lack of inward investment or locally generated surplus for investment. Low growth, in turn, would mean poor revenue, infrastructure and civic services, even in the core areas.

In peri-urban areas, commercial operations – industrial estates, commercial shrimp farms, apartment blocks and large infrastructure projects – would be reduced as a result of low profits and no prospect of additional new investment.

Low growth – assuming no global slowdown affecting international migration – would also mean continued dependency on remittances. Domestic remittances would come from core cities like Dhaka, so long as existing industries – especially garment and textile manufacturing – do not suffer hard times. The more decentralised governance system should in theory provide a more supportive environment for social and economic empowerment of the marginalised areas, including the peri-urban zones. However, with limited resources and external investment there will be no real opportunity for economic development. Continued reliance on social networks is likely to be the solution, especially for those of migrant family members and relatives. On the other hand, being thrown back on their own resources, without any realistic help from outside, may encourage greater self-reliance.

Scenario 4: 'Good', green growth in a decentralised governance system

Under scenario 4, the situation whereby the central government and the core cities control both the economic and political decision-making processes is now shifting towards a more decentralised governance system, where responsibilities and resources are devolved to the periphery's authorities. At the same time, the general context (political, economic, technological) has also allowed a transformational shift away from the business-as-usual economic model towards a greener, more environmentally and socially responsible model.

Both these changes are expected to have drastic impacts on the wellbeing and livelihood of those living in peri-urban areas.

Under this scenario, institutions, especially government, now operate in a system that minimises inter-institution competition and self-interest, and supports integration of development across scales and levels. In this context, the needs and aspirations of those living in peri-urban fringes are better accounted for by more powerful local institutions, leading to important changes in investment in infrastructures in these areas but also in zones connected to these areas (for example, road and railway networks). Besides, these infrastructures are not simply more available, but also greener, thus reducing at least the relative contribution of transport and other economic activities to greenhouse gas emissions. The decentralised governance system also leads to a great improvement in the supply of public services (health, water, sanitation, education), improving significantly the wellbeing and economic prospects of the local populations. In parallel, the decentralised system leads to a reallocation of resources and investment in marginal areas and the periphery, thereby boosting economic activity in these zones. Regulations for planning and construction are relevant to the local level and developed locally help reduce the risk of negative externalities. In particular, building codes and housing standards are implemented and applied neutrally and universally across income groups, settlements, and locations, reducing some forms of vulnerability to climate-related extreme events. Overall, services and infrastructure are better adapted and more resilient to anticipated shocks, and waste management does not damage the environment or other people. Land value in peri-urban areas increases but local regulations and clearer transparent mechanisms ensure that speculation does not hamper healthy investments. Taxation and revenue systems are more transparent and accountable and aim at self-sufficiency – but with citizen oversight and support for an equitable approach at higher scales.

4.6 Wind-tunnelling exercise

The last step in this process is the wind-tunnelling exercise. In our case, the wind-tunnelling exercise consisted in combining the information that was generated through the narrative analysis presented earlier in this report, with that of the four scenarios developed in the previous section. For this exercise, a three-step approach was applied. First a series of policies relevant to urbanisation were identified by the experts, relying on both their expertise and knowledge of the sector and the existing literature. Second, the potential link between these policies and the three main urban resilience narratives was made, using the map presented in Figure 3.3. Third, the 'robustness' of these policies was tested by examining how these policies would likely fit under the four scenarios.

The list of policies considered is provided in the first column of Table 4.2, on the left, while their potential links to the main resilience urban narratives are indicated in the column in the centre. The next four columns on the right hand side summarise the degree of relevance of these policies to the four scenarios. A '+' sign (plus) would indicate a positive relevance – that is, a policy that is likely to fit well with the scenario and to reinforce its general orientation. On the contrary a '–' sign (minus) would indicate a policy that does not sit well in, or is unlikely to be observed under, the scenario considered.

Before moving on to the results of this part of the analysis, it should be noted that the different policies presented in Table 4.2 were chosen by the experts because they are expected to represent current (and/or possibly future) ordinary/frequent policies in relation to the rapid urbanisation characterising the global South. As such, they should be seen as a 'sample' of the types of policies that are currently adopted by national and/or local urban policymakers. But they cannot be considered to be a rigorous representative sample in any statistical sense. They do not claim to have any normative value either. Several would certainly be considered as 'positive' or 'progressive' by some practitioners or academics, while other practitioners would disagree and consider them as too prescriptive. Some would

even consider some of these policies as 'regressive' policies. All could, however, be interpreted as examples of attempts by policymakers to address what are perceived as current urban issues. As such, they are useful for our exercise.

Some salient points emerge from this analysis. One is certainly the absence of any clear trend or pattern and the fact that very few of the policies considered are expected to be supported throughout the four scenarios. Most of the policies display a combination of '+' and '–' signs, suggesting that one would not systematically expect to see them pursued under every scenario. In fact, amongst the 13 policies considered, the only two policies that show four similar (in that case, '+') signs across all the four scenarios are (1) 'Disaster risk reduction measures (early warning, climate hazard model)' and (2) 'Build green wave-breakers to protect residential land'. The interpretation of this finding will be discussed in greater detail in the discussion below.

Table 4.2 Wind-tunnelling exercise

Policies/desired outcomes	**Resilience school of thought**	**S1**	**S2**	**S3**	**S4**
Land regulation eased to favour economic investment	?	+	?	?	–
Secure/protect status of street vendors	Social resilience	–	–	+	+
Support for green public transport, extending into low-income zone	Mix of engineering and social governance (socio-technological transition)	+	–	–	+
Decentralised support for community social capital (urban/peri-urban)	Social resilience	–	–	+	+
Reduce waste and improve resource harvest system in urban context	Ecological resilience	–	+	?	+
Disaster risk reduction measures (early warning, climate hazard model)	Engineering resilience	+	+	+	+
Resource reallocation on basis of vulnerability and deprivation	Social resilience	?	+	?	+
Support the development of peri-urban agriculture	Mix of ecological and social resilience (socio-ecological resilience)	–	?	+	+
Build green wave-breakers to protect residential land	Engineering resilience	+	+	+	+
Regulate and control rural migration in urban areas	?	+	–	?	–
Develop better access to public services in peri-urban areas	Mix of engineering and social governance (socio-technological transition)	–	+	+	+
Support the development of large central urban green parks	Ecological resilience	?	+	?	+
Transparent local-level revenue generation in line with national GDP growth	Social resilience	–	–	+	+

The second salient point that emerges from Table 4.2 is that it seems that resilience in its different interpretations can be related to the vast majority of these different policies. It seems that, due to its very 'flexible' and widely spread scope – ranging from engineering, to ecological, and to social agendas, the concept of resilience provides a narrative that links almost 'naturally' with a large number of current urban issues. In our case amongst the 13 policies that were considered, only two do not seem to offer direct or clear links with any of the existing resilience narratives. These are: (1) 'Land regulation eased to favour economic investment', and (2) 'Regulate and control rural migration in urban areas'.

A closer look at Table 4.2 reveals some further interesting points. First, even if no clear trend seems to emerge about how the policies link with the four scenarios, there is a systematic negative correlation between scenarios 1 and 4. In particular a '+' sign (conversely '–' sign) for a particular policy in relation to scenario 1 will generally be associated with a '–' sign (conversely '+') for scenario 4. The only exceptions to this pattern are the two policies that were identified earlier as displaying a consistent pattern: (1) 'Disaster risk reduction measures (early warning, climate hazard model)' and (2) 'Build green wave-breakers to protect residential land' for which a '+' is observed systematically throughout the four scenarios. For all the other policies, the occurrence of this negative 'correlation' between scenarios 1 and 4 is consistent with the results of the scenario analysis presented in the previous section: scenarios 1 and 4 are localised at two 'opposite' ends of two spectrums, both in terms of governance system (centralised versus decentralised) and in terms of type of growth (green and inclusive versus business-as-usual). It is therefore not necessarily surprising to observe that most policies are characterised by the opposite relation between these two scenarios.

5 Discussion

Combining the results of the narrative and scenario analyses reveals two points worth noticing in relation to urban expansion. First is the observation that the three main urban resilience narratives are not similar/equal with regard to understanding dynamics on the city's fringe. The 'engineering resilience' narrative appears to be relatively neutral, in the sense that it is not supporting, nor undermining the urban expansion agenda. Indeed, the issue of protecting infrastructure against extreme climate-related events, or the need to develop resistance and foster recovery in response to these extreme events is as important at the local level as at the national level. In that regard there is therefore an equal chance of seeing policies that follow the engineering resilience narrative adopted by a centralised government as by a more decentralised governance system that favours the peri-urban agenda. To some extent this finding was also verified indirectly when we observed that the two specific policies that show four '+' signs across all the four scenarios were closely related to the engineering resilience discourse: (1) 'Disaster risk reduction measures (early warning, climate hazard model)' and (2) 'Build green wave-breakers to protect residential land'.

In comparison, the two other resilience narratives are expected to be resolutely more cognisant of peri-urban realities although for different reasons. Ecological resilience puts strong emphasis on issues related to the conservation of biodiversity, and sustainable management of ecosystem services, and some of the practices closely associated with this narrative are directed towards the support of green commons (often located in the peri-urban zone) and urban and peri-urban agriculture. Additionally, a lot of these issues around the conservation of biodiversity and the management of ecosystem services have strong links to different dynamics and processes that are taking place in the peri-urban zones. As such, ecological resilience is therefore expected to be specifically sensitive to the peri-urban environment.

Social resilience is also expected to be supportive of the peri-urban agenda, but for different reasons. Because it puts emphasis on decentralisation, participation or polycentric governance, the social governance narrative is by nature more inclined to pay attention to and address the general lack of visibility and political marginalisation that usually characterise peri-urban zones. In effect, decentralisation is often advocated by those who aim at addressing peri-urban issues. In that context – and this is our second point in this discussion – it should also not be surprising to notice that some scenarios are more supportive of the peri-urban agenda than others. In particular, scenarios 3 and 4, which both reflect situations where government and institutions are expected to operate in ways that support and promote participation and development processes across scales and levels, are more likely to favour the needs and aspirations of those living in peri-urban fringes.

The key salient point that emerges from the analysis is the fact that a large number of urban policies seem to link almost naturally with the resilience agenda. Put differently, it means that resilience – understood in one or the other of the many different urban resilience interpretations – can easily be used to frame a large number of problems/issues related to urban processes. Whether this is globally positive or not depends on different factors but also on how people interpret the same reality. We can identify at least three main reasons why adopting a resilience narrative can have a positive effect in the context of urban policy.

The first is the need to foster adaptation and flexibility in the planning process. Since resilience is by nature a concept that puts emphasis on this idea of adaptation and the dynamic nature of processes, we could reasonably assume that adopting a resilience narrative at the policy agenda or implementation stages will contribute to or facilitate the adoption of policies that endorse and reflect this adaptation feature. This is a clear feature of the ecological resilience narrative (e.g. Ahern 2011; Colding 2007), but also of the

governance narrative (where innovation and transformation are characteristics that are presented as central elements); see for instance, Baud and Hordijk (2009) or Evans (2011). In the case of engineering resilience the situation is more ambiguous. While 'returning to the initial state' implies some degree of dynamic response (e.g. Kreimer, Arnold and Carlin (2003); Wang and Blackmore (2009)), some argue that this focus on persistence or stability may also prevent or hinder the chance of the system embracing a fully adaptive or even transformative approach (Liao 2012).

Secondly, resilience is by nature a concept that emphasises the importance of system thinking and system properties, including cross-scale dynamics and component interactions (Folke 2006; Walker *et al.* 2004). As such, it has been instrumental in helping academics try to influence the way urban planning is now conceptualised and applied in many cities (see e.g. Brown, Dayal and del Rio 2012; Tyler and Moench 2012). There is also growing evidence of the importance of system characteristics such as flexibility, redundancy and modularity, or safe failure as generic principles that are critical in the face of extreme events. Cities that are served by complex and interconnected systems (for example, power, water, transportation, health, etc.) appear far less vulnerable to these extreme events than cities that are wholly dependent on one single central system, with few or no back-up options in the event of a failure (da Silva, Kernaghan and Luque 2012).

Third, resilience is also a very useful concept as a way of integrating discourse, a 'policy broker' that brings practitioners, policymakers, organisations with different agendas, and communities of practice from different sectors together, around the same table, with the same objective – 'strengthening (urban) resilience' (irrespective of what this term means exactly). When disconnected, siloed approaches are a major impediment to appropriate planning, resilience may therefore appear as a powerful tool to break these silos and ensure a more integrated process.

Yet as the narrative analysis has shown, the interpretations of what resilience is, what it is expected to achieve, what issues are at stake and what characteristics of resilience are important, are rather heteroclite and vary widely across the spectrum. In fact, whether resilience should be used as a loose metaphor to 'inspire' the policy agenda or as a rigorous analytical framework to solve a technical problem is not clear, and both approaches are widely found in the literature. Furthermore, some see resilience as the ultimate objective that should drive the entire urbanisation process, while others use it as a way to frame the problem or even simply to stimulate discussion, either within a particular sector or discipline, or across sectors and disciplines. Finally, some academics – and possibly policymakers – clearly use it as a buzzword, contributing to the feeling that resilience is nothing more than old wine in a new bottle. In the light of our analysis, it is indeed reasonable to assert that resilience is this too, to some extent.

6 Conclusion and recommendations

These recommendations are addressed to those with direct influence on policies and programmes related to urban planning. Civil society and media should monitor and evaluate the use of the resilience narrative in the actions of these key players and collect evidence on outcomes.

Resilience used in the context of peri-urban expansion can be very useful but it needs to be considered and used with care and rigour. At the present time many different views of what urban resilience means are found in the literature. Underlying these views are various (and sometimes diverging) interpretations of what the main issues are and of what policies are needed to address these issues. Urban planners need to be better aware of these different interpretations if they want to be in a position to use resilience appropriately and spell out what resilience can bring to their work.

1. Resilience is useful where there is a need to foster adaptation, flexibility and robustness in the planning process. Since resilience is by nature a concept that puts emphasis on adaptation and the dynamic nature of systems, adopting a resilience narrative in relation to urbanisation planning could contribute to the adoption of policies that endorse and reflect these features.
2. Resilience also emphasises the importance of system thinking and system properties. As such it can be instrumental in helping urban planners in their tasks in many different contexts. There is for instance a wide consensus on the importance of system characteristics such as flexibility, redundancy and modularity and safe failure as critical principles for urban planning, especially in response to climate change-related extreme events.
3. The term ‘resilience’ is used in ill-defined, multiple and potentially incompatible ways. It can refer to resilience as a goal, as an analytical/operational framework, as a metaphor to link ecological and social systems, as well as a (largely meaningless) buzzword. It is therefore imperative that those employing the term and concept are explicit in how the term is being used and defined.
4. At the same time, the loose definition of resilience can be useful as a form of integrating discourse. It can act as a ‘policy broker’ to bring practitioners, policymakers, local actors, and communities of practice with different (or divergent) agendas together around the same table. When disconnected agendas are a major impediment for appropriate planning, resilience may prove useful to break these silos and ensure a more integrated planning process.
5. Key urban resilience narratives can be mapped into three groups: (1) urban hazards and disaster risk reduction, underpinned by an engineering perspective; (2) urban ecological resilience, underpinned by ecology and ecosystem services; and (3) urban resilience through governance and institutions, underpinned by a social view of resilience. Combining perspectives from all three is crucial to tackling climate shocks in the context of the institutions and governance processes that shape linked social and ecological systems.
6. While there may be a tendency to view peri-urban areas as ‘emergent’, the processes that feed into the interplay between resilience and peri-urban expansion can occur over the very long term, with deep-rooted interconnections between the urban, peri-urban and rural. This implies that when urban planners seek to identify factors contributing to urban resilience, or identify strategies to foster resilience, they need to cast their lens on the historical trajectories of wider sociopolitical and economic processes, which

explicitly include both urban and rural dynamics, alongside an analysis of contemporary processes.

7. Urban resilience need not be state-centric. As peri-urban spaces expand, urban planners may look for ways to create ownership of the drivers of resilience amongst organisations of the urban poor and those who might be otherwise marginalised.
8. The urban resilience agenda is not explicitly normative regarding advancing the needs and interests of the most marginalised and disenfranchised groups who experience citizenship in very contradictory terms in cities of the global South. These groups are often usually unrecognised and get by through informal means, because they are excluded from formal titles to land as well as good and basic services. The poor and marginalised are usually adaptive and have developed flexible and resilient strategies and livelihoods. This is despite systematic exclusion and despite being the most vulnerable to climatic shocks and stresses. However, there are limits to romanticising their 'resilience', which could also be seen as a form of coping strategy, in the face of no other alternative. It is also these groups that often pay the price to ensure the resilience of others – that is, they are often displaced from the city's centre or from so-called ecologically fragile areas such as Mumbai's mangroves in order to enhance the 'resilience' of the city, usually to the benefit of the middle and upper classes.

Appendix 1

The initial 64 articles selected using the inclusion/exclusion criteria as presented in Section 3.2

1.	Title: Community action planning in East Delhi: a participatory approach to build urban disaster resilience Author(s): Prashar, Sunil; Shaw, Rajib; Takeuchi, Yukiko Source: MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE Volume: 18 Issue: 4 Pages: 429-448 DOI: 10.1007/s11027-012-9368-4 Published: APR 2013
2.	Title: Configuring transformative governance to enhance resilient urban water systems Author(s): Rijke, J.; Farrelly, M.; Brown, R.; *et al.* Source: ENVIRONMENTAL SCIENCE & POLICY Volume: 25 Pages: 62-72 DOI: 10.1016/j.envsci.2012.09.012 Published: JAN 2013
3.	Title: Mainstreaming disaster resilience attributes in local development plans for the adaptation to climate change induced flooding: A study based on the local plan of Shah Alam City, Malaysia Author(s): Khailani, Dzul Khaimi; Perera, Ranjith Source: LAND USE POLICY Volume: 30 Issue: 1 Pages: 615-627 DOI: 10.1016/j.landusepol.2012.05.003 Published: JAN 2013
4.	Title: Risk, Resiliency, and Urban Governance: The Case of the 2010 Winter Olympic Games Author(s): Boyle, Philip Source: CANADIAN REVIEW OF SOCIOLOGY-REVUE CANADIENNE DE SOCIOLOGIE Volume: 49 Issue: 4 Pages: 350-369 DOI: 10.1111/j.1755-618X.2012.01301.x Published: NOV 2012
5.	Title: From practice to theory: emerging lessons from Asia for building urban climate change resilience Author(s): Brown, Anna; Dayal, Ashvin; del Rio, Cristina Rumbaitis Source: ENVIRONMENT AND URBANIZATION Volume: 24 Issue: 2 Pages: 531-556 DOI: 10.1177/0956247812456490 Published: OCT 2012
6.	Title: Academic achievement of African American boys: A city-wide, community-based investigation of risk and resilience Author(s): Fantuzzo, John; LeBoeuf, Whitney; Rouse, Heather; et al. Source: JOURNAL OF SCHOOL PSYCHOLOGY Volume: 50 Issue: 5 Pages: 559-579 DOI: 10.1016/j.jsp.2012.04.004 Published: OCT 2012
7.	Title: Harvesting urban resources towards more resilient cities Author(s): Agudelo-Vera, Claudia M.; Leduc, Wouter R. W. A.; Mels, Adriaan R.; et al. Source: RESOURCES CONSERVATION AND RECYCLING Volume: 64 Special Issue: SI Pages: 3-12 DOI: 10.1016/j.resconrec.2012.01.014 Published: JUL 2012
8.	Title: Resilience and Well-being Among Urban Ethiopian Children: What Role Do Social Resources and Competencies Play? Author(s): Camfield, Laura Source: SOCIAL INDICATORS RESEARCH Volume: 107 Issue: 3 Pages: 393-410 DOI: 10.1007/s11205-011-9860-3 Published: JUL 2012
9.	Title: Protecting the NFL/militarizing the homeland: Citizen soldiers and urban resilience in post-9/11 America Author(s): Schimmel, Kimberly S. Source: INTERNATIONAL REVIEW FOR THE SOCIOLOGY OF SPORT Volume: 47 Issue: 3 Special Issue: SI Pages: 338-357 DOI: 10.1177/1012690211433479 Published: JUN 2012
10.	Title: Identifying Individual, Cultural and Asthma-Related Risk and Protective Factors Associated With Resilient Asthma Outcomes in Urban Children and Families Author(s): Koinis-Mitchell, Daphne; McQuaid, Elizabeth L.; Jandasek, Barbara; et al. Source: JOURNAL OF PEDIATRIC PSYCHOLOGY Volume: 37 Issue: 4 Pages: 424-437 DOI: 10.1093/jpepsy/jss002 Published: MAY 2012

11.	Title: Financing the resilient city Author(s): Brugmann, Jeb Source: ENVIRONMENT AND URBANIZATION Volume: 24 Issue: 1 Pages: 215-232 DOI: 10.1177/0956247812437130 Published: APR 2012
12.	Title: A Theory on Urban Resilience to Floods-A Basis for Alternative Planning Practices Author(s): Liao, Kuei-Hsien Source: ECOLOGY AND SOCIETY Volume: 17 Issue: 4 Article Number: 48 DOI: 10.5751/ES-05231-170448 Published: 2012
13.	Title: RESILIENCE AMONG URBAN AMERICAN INDIAN ADOLESCENTS: EXPLORATION INTO THE ROLE OF CULTURE, SELF-ESTEEM, SUBJECTIVE WELL-BEING, AND SOCIAL SUPPORT Author(s): Stumblingbear-Riddle, Glenna; Romans, John S. C. Source: AMERICAN INDIAN AND ALASKA NATIVE MENTAL HEALTH RESEARCH Volume: 19 Issue: 2 Pages: 1-19 Published: 2012
14.	Title: Toward the Climate-Resilient City: Extreme Weather and Urban Climate Adaptation Policies in Two Canadian Provinces Author(s): Henstra, Daniel Source: JOURNAL OF COMPARATIVE POLICY ANALYSIS Volume: 14 Issue: 2 Special Issue: SI Pages: 175-194 DOI: 10.1080/13876988.2012.665215 Published: 2012
15.	Title: Making cities resilient: Increasing resilience to disasters at the local level. Author(s): Albrito, Paola Source: Journal of business continuity & emergency planning Volume: 5 Issue: 4 Pages: 291-7 Published: 2012
16.	Title: Assessing and monitoring urban resilience using COPD in Porto Author(s): Monteiro, Ana; Carvalho, Vania; Velho, Sara; et al. Source: SCIENCE OF THE TOTAL ENVIRONMENT Volume: 414 Pages: 113-119 DOI: 10.1016/j.scitotenv.2011.11.009 Published: JAN 1 2012
17.	Title: New policies to deal with climate change and other drivers impacting on resilience to flooding in urban areas: the CORFU approach Author(s): Djordjevic, Slobodan; Butler, David; Gourbesville, Philippe; et al. Source: ENVIRONMENTAL SCIENCE & POLICY Volume: 14 Issue: 7 Special Issue: SI Pages: 864-873 DOI: 10.1016/j.envsci.2011.05.008 Published: NOV 2011
18.	Title: Challenges and Resilience in the Lives of Urban, Multiracial Adults: An Instrument Development Study Author(s): Salahuddin, Nazish M.; O'Brien, Karen M. Source: JOURNAL OF COUNSELING PSYCHOLOGY Volume: 58 Issue: 4 Pages: 494-507 DOI: 10.1037/a0024633 Published: OCT 2011
19.	Title: A Socially Resilient Urban Transition? The Contested Landscapes of Apartment Building Extensions in Two Post-communist Cities Author(s): Bouzarovski, Stefan; Salukvadze, Joseph; Gentile, Michael Source: URBAN STUDIES Volume: 48 Issue: 13 Pages: 2689-2714 DOI: 10.1177/0042098010385158 Published: OCT 2011
20.	Title: Community resilience, quality childcare, and preschoolers' mental health: A three-city comparison Author(s): Maggi, Stefania; Roberts, William; MacLennan, David; et al. Source: SOCIAL SCIENCE & MEDICINE Volume: 73 Issue: 7 Pages: 1080-1087 DOI: 10.1016/j.socscimed.2011.06.052 Published: OCT 2011
21.	Title: Teacher Resilience in Urban Schools: The Importance of Technical Knowledge, Professional Community, and Leadership Opportunities Author(s): Yonezawa, Susan; Jones, Makeba; Singer, Nancy Robb Source: URBAN EDUCATION Volume: 46 Issue: 5 Pages: 913-931 DOI: 10.1177/0042085911400341 Published: SEP 2011
22.	Title: A method for building community resilience to climate change in emerging coastal cities Author(s): Smith, Timothy F.; Daffara, Phillip; O'Toole, Kevin; et al. Source: FUTURES Volume: 43 Issue: 7 Special Issue: SI Pages: 673-679 DOI: 10.1016/j.futures.2011.05.008 Published: SEP 2011

23.	Title: The Effect of Resilience on Posttraumatic Stress Disorder in Trauma-Exposed Inner-City Primary Care Patients Author(s): Wrenn, Glenda L.; Wingo, Aliza P.; Moore, Renee; et al. Source: JOURNAL OF THE NATIONAL MEDICAL ASSOCIATION Volume: 103 Issue: 7 Pages: 560-566 Published: JUL 2011
24.	Title: Resilience of Andean urban ethnobotanies: A comparison of medicinal plant use among Bolivian and Peruvian migrants in the United Kingdom and in their countries of origin Author(s): Ceuterick, Melissa; Vandebroek, Ina; Pieroni, Andrea Source: JOURNAL OF ETHNOPHARMACOLOGY Volume: 136 Issue: 1 Pages: 27-54 DOI: 10.1016/j.jep.2011.03.038 Published: JUN 14 2011
25.	Title: Flood-Resilient Waterfront Development in New York City: Bridging Flood Insurance, Building Codes, and Flood Zoning Author(s): Aerts, Jeroen C. J. H.; Botzen, W. J. Wouter Source: FLOOD-RESILIENT WATERFRONT DEVELOPMENT IN NEW YORK CITY: BRIDGING FLOOD INSURANCE, BUILDING CODES, AND FLOOD ZONING Book Series: Annals of the New York Academy of Sciences Volume: 1227 Pages: 1-82 DOI: 10.1111/j.1749-6632.2011.06074.x Published: 2011 Publisher: BLACKWELL SCIENCE PUBL, OSNEY MEAD, OXFORD OX2 0EL, ENGLAND
26.	Title: From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world Author(s): Ahern, Jack Source: LANDSCAPE AND URBAN PLANNING Volume: 100 Issue: 4 Special Issue: SI Pages: 341-343 DOI: 10.1016/j.landurbplan.2011.02.021 Published: APR 30 2011
27.	Title: Resilience, Restoration, and Riparian Ecosystems: Case Study of a Dry land, Urban River Author(s): White, Jacqueline M.; Stromberg, Juliet C. Source: RESTORATION ECOLOGY Volume: 19 Issue: 1 Pages: 101-111 DOI: 10.1111/j.1526-100X.2009.00531.x Published: JAN 2011
28.	Title: Historical Regimes and Social Indicators of Resilience in an Urban System: the Case of Charleston, South Carolina Author(s): Bures, Regina; Kanapaux, William Source: ECOLOGY AND SOCIETY Volume: 16 Issue: 4 Article Number: 16 DOI: 10.5751/ES-04293-160416 Published: 2011
29.	Title: From Resilience to Transformation: the Adaptive Cycle in Two Mexican Urban Centers Author(s): Pelling, Mark; Manuel-Navarrete, David Source: ECOLOGY AND SOCIETY Volume: 16 Issue: 2 Article Number: 11 Published: 2011
30.	Title: Resilience and sustainability in US urban areas Author(s): Pierce, J. C.; Budd, W. W.; Lovrich, N. P., Jr. Source: ENVIRONMENTAL POLITICS Volume: 20 Issue: 4 Pages: 566-584 DOI: 10.1080/09644016.2011.589580 Published: 2011 Times Cited: 1 (from All Databases)
31.	Title: Urban Transitions: On Urban Resilience and Human-Dominated Ecosystems Author(s): Ernstson, Henrik; van der Leeuw, Sander E.; Redman, Charles L.; et al. Source: AMBIO Volume: 39 Issue: 8 Pages: 531-545 DOI: 10.1007/s13280-010-0081-9 Published: DEC 2010
32.	Title: In pursuit of resilient, low carbon communities: An examination of barriers to action in three Canadian cities Author(s): Burch, Sarah Source: ENERGY POLICY Volume: 38 Issue: 12 Pages: 7575-7585 DOI: 10.1016/j.enpol.2009.06.070 Published: DEC 2010
33.	Title: Operationalising a resilience approach to adapting an urban delta to uncertain climate changes Author(s): Wardekker, J. Arjan; de Jong, Arie; Knoop, Joost M.; et al. Source: TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE Volume: 77 Issue: 6 Pages: 987-998 DOI: 10.1016/j.techfore.2009.11.005 Published: JUL 2010
34.	Title: Tsunami height poles and disaster awareness memory, education and awareness of disaster on the reconstruction for resilient city in Banda Aceh, Indonesia Author(s): Sugimoto, Megumi; Iemura, Hirokazu; Shaw, Rajib Source: DISASTER PREVENTION AND MANAGEMENT Volume: 19 Issue: 5 Pages: 527-540 DOI: 10.1108/09653561011091869 Published: 2010

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36.	Title: Agricultural knowledge in urban and resettled communities: applications to social-ecological resilience and environmental education Author(s): Shava, Soul; Krasny, Marianne E.; Tidball, Keith G.; et al. Source: ENVIRONMENTAL EDUCATION RESEARCH Volume: 16 Issue: 5-6 Pages: 575-589 Article Number: PII 928353658 DOI: 10.1080/13504622.2010.505436 Published: 2010
37.	Title: The Functional Resilience of an Innovative Cluster in the Montpellier Urban Area (South of France) Author(s): Bonnet, Nicolas Source: EUROPEAN PLANNING STUDIES Volume: 18 Issue: 9 Pages: 1345-1363 Article Number: PII 925286320 DOI: 10.1080/09654313.2010.492580 Published: 2010
38.	Title: Hanoi's Ancient Quarter Traders: Resilient Livelihoods in a Rapidly Transforming City Author(s): Turner, Sarah Source: URBAN STUDIES Volume: 46 Issue: 5-6 Pages: 1203-1221 DOI: 10.1177/0042098009103861 Published: MAY 2009
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42.	Title: Critical Commentary. Waking from the Dream: An Australian Perspective on Urban Resilience Author(s): Gleeson, Brendan Source: URBAN STUDIES Volume: 45 Issue: 13 Pages: 2653-2668 DOI: 10.1177/0042098008098198 Published: DEC 2008
43.	Title: Incorporating resilience into sustainability indicators: An example for the urban water sector Author(s): Milman, Anita; Short, Anne Source: GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS Volume: 18 Issue: 4 Special Issue: SI Pages: 758-767 DOI: 10.1016/j.gloenvcha.2008.08.002 Published: OCT 2008
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46.	Title: The academic resilience and psychosocial characteristics of inner-city English learners in a museum-based school program Author(s): Kanevsky, Lannie; Corke, Michael; Frangkiser, Lorri Source: EDUCATION AND URBAN SOCIETY Volume: 40 Issue: 4 Pages: 452-475 DOI: 10.1177/0013124507304693 Published: MAY 2008
47.	Title: Urban Systems during Disasters: Factors for Resilience Author(s): Wallace, Deborah; Wallace, Rodrick Source: ECOLOGY AND SOCIETY Volume: 13 Issue: 1 Article Number: 18 Published: 2008

48.	Title: An evaluation of the ichthyofauna of the Bronx river, a resilient urban waterway (vol 14, pg 534, 2007) Author(s): Rachlin, Joseph W.; Warkentine, Barbara E.; Pappantoniou, Antonios Source: NORTHEASTERN NATURALIST Volume: 15 Issue: 1 Pages: 158-158 Published: 2008
49.	Title: A failure of resilience: Estimating response of New York City's public health ecosystem to sudden disaster Author(s): Wallace, Rodrick; Wallace, Deborah; Ahern, Jennifer; et al. Source: HEALTH & PLACE Volume: 13 Issue: 2 Pages: 545-550 DOI: 10.1016/j.healthplace.2006.07.006 Published: JUN 2007
50.	Title: Understanding the Relationship between Resiliency and Bullying in Adolescence: An Assessment of Youth Resiliency from Five Urban Junior High Schools Author(s): Donnon, Tyrone; Hammond, Wayne Source: CHILD AND ADOLESCENT PSYCHIATRIC CLINICS OF NORTH AMERICA Volume: 16 Issue: 2 Pages: 449—71 DOI: 10.1016/j.chc.2006.11.007 Published: APR 2007
51	Title: Adapting to climate change: water management for urban resilience Author(s): Muller, Mike Source: ENVIRONMENT AND URBANIZATION Volume: 19 Issue: 1 Pages: 99-113 DOI: 10.1177/0956247807076726 Published: APR 2007 Times Cited: 24 (from All Databases)
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57.	Title: Building resilient urban communities Author(s): Davis, Ian; Izadkhah, Yasamin O. Source: OPEN HOUSE INTERNATIONAL Volume: 31 Issue: 1 Pages: 11-21 Published: MAR 2006
58.	Title: Psychological resilience after disaster - New York City in the aftermath of the September 11th terrorist attack Author(s): Bonanno, GA; Galea, S; Bucciarelli, A; et al. Source: PSYCHOLOGICAL SCIENCE Volume: 17 Issue: 3 Pages: 181-186 DOI: 10.1111/j.1467-9280.2006.01682.x Published: MAR 2006
59.	Title: Resilience among urban adolescent mothers living with violence - Listening to their stories Author(s): Kennedy, AC Source: VIOLENCE AGAINST WOMEN Volume: 11 Issue: 12 Pages: 1490-1514 DOI: 10.1177/1077801205280274 Published: DEC 2005
60.	Title: Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms Author(s): Pickett, STA; Cadenasso, ML; Grove, JM Source: LANDSCAPE AND URBAN PLANNING Volume: 69 Issue: 4 Pages: 369-384 DOI: 10.1016/j.landurpbplan.2003.10.035 Published: OCT 30 2004

61.	Title: Ecological resilience in urban ecosystems: Linking urban patterns to human and ecological functions Author(s): Alberti, Marina; Marzluff, John M. Source: Urban Ecosystems Volume: 7 Issue: 3 Pages: 241-265 DOI: 10.1023/B:UECO.0000044038.90173.c6 Published: September 2004
62.	Title: Risk and resiliency factors influencing suicidality among urban African American and Latino youth Author(s): O'Donnell, L; O'Donnell, C; Wardlaw, DM; et al. Source: AMERICAN JOURNAL OF COMMUNITY PSYCHOLOGY Volume: 33 Issue: 1-2 Pages: 37-49 DOI: 10.1023/B:AJCP.0000014317.20704.0b Published: MAR 2004
63.	Title: Urban Hazard Mitigation: Creating Resilient Cities Author(s): Godschalk, David R. Source: NATURAL HAZARDS REVIEW Volume: 4 Issue: 3 Pages: 136-143 DOI: 10.1061/(ASCE)1527-6988(2003)4:3(136) Published: AUG 2003
64.	Title: Elements of resilience after the World Trade Center disaster: Reconstituting New York City's Emergency Operations Centre Author(s): Kendra, JM; Wachtendorf, T Source: DISASTERS Volume: 27 Issue: 1 Pages: 37-53 DOI: 10.1111/1467-7717.00218 Published: MAR 2003

Appendix 2

List of 39 articles used for the narrative analysis

1.	Title: Harvesting urban resources towards more resilient cities Author(s): Agudelo-Vera, Claudia M.; Leduc, Wouter R. W. A.; Mels, Adriaan R.; et al. Source: RESOURCES CONSERVATION AND RECYCLING Volume: 64 Special Issue: SI Pages: 3-12 DOI: 10.1016/j.resconrec.2012.01.014 Published: JUL 2012
2.	Title: From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world Author(s): Ahern, Jack Source: LANDSCAPE AND URBAN PLANNING Volume: 100 Issue: 4 Special Issue: SI Pages: 341-343 DOI: 10.1016/j.landurbplan.2011.02.021 Published: APR 30 2011
3.	Title: Ecological resilience in urban ecosystems: Linking urban patterns to human and ecological functions Author(s): Alberti, Marina; Marzluff, John M. Source: Urban Ecosystems Volume: 7 Issue: 3 Pages: 241-265 DOI: 10.1023/B:UECO.0000044038.90173.c6 Published: September 2004
4.	Title: Making cities resilient: Increasing resilience to disasters at the local level. Author(s): Albrito, Paola Source: Journal of business continuity & emergency planning Volume: 5 Issue: 4 Pages: 291-7 Published: 2012
5.	Title: The Functional Resilience of an Innovative Cluster in the Montpellier Urban Area (South of France) Author(s): Bonnet, Nicolas Source: EUROPEAN PLANNING STUDIES Volume: 18 Issue: 9 Pages: 1345-1363 Article Number: PII 925286320 DOI: 10.1080/09654313.2010.492580 Published: 2010
6.	Title: A Socially Resilient Urban Transition? The Contested Landscapes of Apartment Building Extensions in Two Post-communist Cities Author(s): Bouzarovski, Stefan; Salukvadze, Joseph; Gentile, Michael Source: URBAN STUDIES Volume: 48 Issue: 13 Pages: 2689-2714 DOI: 10.1177/0042098010385158 Published: OCT 2011
7.	Title: Risk, Resiliency, and Urban Governance: The Case of the 2010 Winter Olympic Games Author(s): Boyle, Philip Source: CANADIAN REVIEW OF SOCIOLOGY-REVUE CANADIENNE DE SOCIOLOGIE Volume: 49 Issue: 4 Pages: 350-369 DOI: 10.1111/j.1755-618X.2012.01301.x Published: NOV 2012
8.	Title: From practice to theory: emerging lessons from Asia for building urban climate change resilience Author(s): Brown, Anna; Dayal, Ashvin; del Rio, Cristina Rumbaitis Source: ENVIRONMENT AND URBANIZATION Volume: 24 Issue: 2 Pages: 531-556 DOI: 10.1177/0956247812456490 Published: OCT 2012
9.	Title: Financing the resilient city Author(s): Brugmann, Jeb Source: ENVIRONMENT AND URBANIZATION Volume: 24 Issue: 1 Pages: 215-232 DOI: 10.1177/0956247812437130 Published: APR 2012
10.	Title: In pursuit of resilient, low carbon communities: An examination of barriers to action in three Canadian cities Author(s): Burch, Sarah Source: ENERGY POLICY Volume: 38 Issue: 12 Pages: 7575-7585 DOI: 10.1016/j.enpol.2009.06.070 Published: DEC 2010
11.	Title: Historical Regimes and Social Indicators of Resilience in an Urban System: the Case of Charleston, South Carolina Author(s): Bures, Regina; Kanapaux, William Source: ECOLOGY AND SOCIETY Volume: 16 Issue: 4 Article Number: 16 DOI: 10.5751/ES-04293-160416 Published: 2011

12.	Title: Urban resilience and the recovery of New Orleans Author(s): Campanella, TJ Source: JOURNAL OF THE AMERICAN PLANNING ASSOCIATION Volume: 72 Issue: 2 Pages: 141-146 DOI: 10.1080/01944360608976734 Published: SPR 2006
13.	Title: Risk, resilience, and environmentally sustainable cities Author(s): Coaffee, Jon Source: ENERGY POLICY Volume: 36 Issue: 12 Pages: 4633-4638 DOI: 10.1016/j.enpol.2008.09.048 Published: DEC 2008
14.	Title: Building resilient urban communities Author(s): Davis, Ian; Izadkhah, Yasamin O. Source: OPEN HOUSE INTERNATIONAL Volume: 31 Issue: 1 Pages: 11-21 Published: MAR 2006
15.	Title: New policies to deal with climate change and other drivers impacting on resilience to flooding in urban areas: the CORFU approach Author(s): Djordjevic, Slobodan; Butler, David; Gourbesville, Philippe; et al. Source: ENVIRONMENTAL SCIENCE & POLICY Volume: 14 Issue: 7 Special Issue: SI Pages: 864-873 DOI: 10.1016/j.envsci.2011.05.008 Published: NOV 2011
16.	Title: Urban Transitions: On Urban Resilience and Human-Dominated Ecosystems Author(s): Ernstson, Henrik; van der Leeuw, Sander E.; Redman, Charles L.; et al. Source: AMBIO Volume: 39 Issue: 8 Pages: 531-545 DOI: 10.1007/s13280-010-0081-9 Published: DEC 2010
17.	Title: Critical Commentary. Waking from the Dream: An Australian Perspective on Urban Resilience Author(s): Gleeson, Brendan Source: URBAN STUDIES Volume: 45 Issue: 13 Pages: 2653-2668 DOI: 10.1177/0042098008098198 Published: DEC 2008
18.	Title: Urban Hazard Mitigation: Creating Resilient Cities Author(s): Godschalk, David R. Source: NATURAL HAZARDS REVIEW Volume: 4 Issue: 3 Pages: 136-143 DOI: 10.1061/(ASCE)1527-6988(2003)4:3(136) Published: AUG 2003
19.	Title: Toward the Climate-Resilient City: Extreme Weather and Urban Climate Adaptation Policies in Two Canadian Provinces Author(s): Henstra, Daniel Source: JOURNAL OF COMPARATIVE POLICY ANALYSIS Volume: 14 Issue: 2 Special Issue: SI Pages: 175-194 DOI: 10.1080/13876988.2012.665215 Published: 2012
20.	Title: Quantifying Biodiversity for Building Resilience for Food Security in Urban Landscapes: Getting Down to Business Author(s): Jansson, Asa; Polasky, Steven Source: ECOLOGY AND SOCIETY Volume: 15 Issue: 3 Article Number: 20 Published: 2010
21.	Title: Mainstreaming disaster resilience attributes in local development plans for the adaptation to climate change induced flooding: A study based on the local plan of Shah Alam City, Malaysia Author(s): Khailani, Dzul Khaimi; Perera, Ranjith Source: LAND USE POLICY Volume: 30 Issue: 1 Pages: 615-627 DOI: 10.1016/j.landusepol.2012.05.003 Published: JAN 2013
22.	Title: A Theory on Urban Resilience to Floods-A Basis for Alternative Planning Practices Author(s): Liao, Kuei-Hsien Source: ECOLOGY AND SOCIETY Volume: 17 Issue: 4 Article Number: 48 DOI: 10.5751/ES-05231-170448 Published: 2012
23.	Title: Incorporating resilience into sustainability indicators: An example for the urban water sector Author(s): Milman, Anita; Short, Anne Source: GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS Volume: 18 Issue: 4 Special Issue: SI Pages: 758-767 DOI: 10.1016/j.gloenvcha.2008.08.002 Published: OCT 2008
24.	Title: Assessing and monitoring urban resilience using COPD in Porto Author(s): Monteiro, Ana; Carvalho, Vania; Velho, Sara; et al. Source: SCIENCE OF THE TOTAL ENVIRONMENT Volume: 414 Pages: 113-119 DOI: 10.1016/j.scitotenv.2011.11.009 Published: JAN 1 2012

25.	Title: Adapting to climate change: water management for urban resilience Author(s): Muller, Mike Source: ENVIRONMENT AND URBANIZATION Volume: 19 Issue: 1 Pages: 99-113 DOI: 10.1177/0956247807076726 Published: APR 2007
26.	Title: From Resilience to Transformation: the Adaptive Cycle in Two Mexican Urban Centers Author(s): Pelling, Mark; Manuel-Navarrete, David Source: ECOLOGY AND SOCIETY Volume: 16 Issue: 2 Article Number: 11 Published: 2011
27.	Title: Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms Author(s): Pickett, STA; Cadenasso, ML; Grove, JM Source: LANDSCAPE AND URBAN PLANNING Volume: 69 Issue: 4 Pages: 369-384 DOI: 10.1016/j.landurpbplan.2003.10.035 Published: OCT 30 2004
28.	Title: Resilience and sustainability in US urban areas Author(s): Pierce, J. C.; Budd, W. W.; Lovrich, N. P., Jr. Source: ENVIRONMENTAL POLITICS Volume: 20 Issue: 4 Pages: 566-584 DOI: 10.1080/09644016.2011.589580 Published: 2011
29.	Title: Community action planning in East Delhi: a participatory approach to build urban disaster resilience Author(s): Prashar, Sunil; Shaw, Rajib; Takeuchi, Yukiko Source: MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE Volume: 18 Issue: 4 Pages: 429-448 DOI: 10.1007/s11027-012-9368-4 Published: APR 2013
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31.	Title: Configuring transformative governance to enhance resilient urban water systems Author(s): Rijke, J.; Farrelly, M.; Brown, R.; et al. Source: ENVIRONMENTAL SCIENCE & POLICY Volume: 25 Pages: 62-72 DOI: 10.1016/j.envsci.2012.09.012 Published: JAN 2013
32.	Title: A method for building community resilience to climate change in emerging coastal cities Author(s): Smith, Timothy F.; Daffara, Phillip; O'Toole, Kevin; et al. Source: FUTURES Volume: 43 Issue: 7 Special Issue: SI Pages: 673-679 DOI: 10.1016/j.futures.2011.05.008 Published: SEP 2011
33.	Title: Tsunami height poles and disaster awareness Memory, education and awareness of disaster on the reconstruction for resilient city in Banda Aceh, Indonesia Author(s): Sugimoto, Megumi; Iemura, Hirokazu; Shaw, Rajib Source: DISASTER PREVENTION AND MANAGEMENT Volume: 19 Issue: 5 Pages: 527-540 DOI: 10.1108/09653561011091869 Published: 2010 Times Cited: 0 (from All Databases) [View abstract]
34.	Title: 'Eco-city' to 'disaster-resilient eco-community': a concerted approach in the coastal city of Puri, India Author(s): Surjan, Akhilesh Kumar; Shaw, Rajib Source: SUSTAINABILITY SCIENCE Volume: 3 Issue: 2 Pages: 249-265 DOI: 10.1007/s11625-008-0051-3 Published: OCT 2008
35.	Title: Hanoi's Ancient Quarter Traders: Resilient Livelihoods in a Rapidly Transforming City Author(s): Turner, Sarah Source: URBAN STUDIES Volume: 46 Issue: 5-6 Pages: 1203-1221 DOI: 10.1177/0042098009103861 Published: MAY 2009
36.	Title: Urban Systems during Disasters: Factors for Resilience Author(s): Wallace, Deborah; Wallace, Rodrick Source: ECOLOGY AND SOCIETY Volume: 13 Issue: 1 Article Number: 18 Published: 2008
37.	Title: A failure of resilience: Estimating response of New York City's public health ecosystem to sudden disaster Author(s): Wallace, Rodrick; Wallace, Deborah; Ahern, Jennifer; et al. Source: HEALTH & PLACE Volume: 13 Issue: 2 Pages: 545-550 DOI: 10.1016/j.healthplace.2006.07.006 Published: JUN 2007

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